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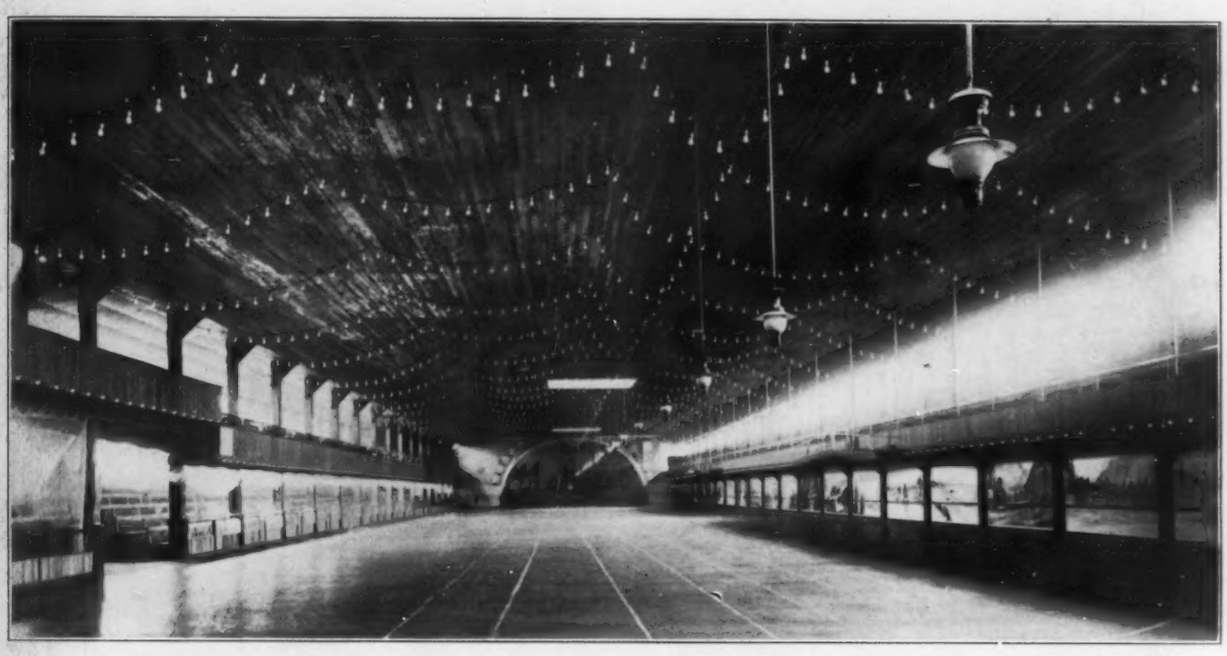


The Auditorium, San Francisco. In this building the Mechanics' Fair will be held during the week beginning June 14th.

NATIONAL ASSOCIATION STATIONARY ENGINEERS.

FRED J. FISCHER, National President.

The National Association of Stationary Engineers, whose California subsidiary association meets in annual convention at San Francisco during the coming week, represents the highest type of that great body of progressive men, the steam engineers. The object of the association is primarily educative and incidentally fraternal. Organized in 1882, it has successfully waged a campaign of technical enlightenment of its members that has been potent in advancing the art of steam engineering to its present high standard. In California there are eight subordinate associations with several more applying for admission at this convention. In Arizona there are four, in Colorado six, in Oregon two and in Washington four, which hold weekly meetings to hear talks on all the varied apparatus comprising a modern power plant. It discountenances any project disturbing harmonious relations between employer and employee.

With such laudable purposes in view the association is worthy of the active support of everyone interested in steam engineering. Such support has been lent by many of the great machinery manufacturers of the country who have prepared exhibits of late developments for the Mechanics' Fair to be held in conjunction with the convention. Their local representatives are to be commended for their zeal in preparing interesting displays in such a short time. In consequence this fair will be the most comprehensive and complete exhibit of power machinery ever held in the West and it merits careful inspection. Attendance at the meetings and fair will also show that the welcome to visiting delegates is as sincere as it is hearty.

WELCOME TO THE ENGINEERS.

H. D. Saville.

The local members of the National Association of Stationary Engineers have made very complete preparations for the care and entertainment of the visiting members of the order who will be in attendance at the sixth annual convention to be held in San Francisco during the week beginning June 14th.

The various committees working under the direction of State President Saville have spared neither effort nor expense to make this the banner convention in the history of the association.

In addition to the arrangements for the social entertainment of the members and their families a most interesting program has been provided for the business session which, in connection with the machinery and supply exhibits of the Mechanics' Fair to be held in conjunction with the convention, should prove unusually instructive.

Through the medium of the "Journal of Electricity, Power and Gas," President Saville extends the following welcome to the visitors:

To the Delegates and Members of the National Association of Stationary Engineers:

DEAR SIRS AND BROTHERS:—

The local committee for the arrangement of the details of our sixth annual convention, to be held in San Francisco during the week of June 14th to 19th, inclusive, have about completed their labors, with the result that the care and comfort of all those attending the convention have been arranged for.

The Mechanics' Fair which will be given in conjunction with the convention I believe will well reward any person mechanically inclined who will visit and carefully inspect it. The fullest opportunity will be afforded all to view the wonderful progress that has been made in rearing the new city, Phoenix-like, on the ruins of the disaster of 1906, and the many points of natural interest surrounding the bay and city will be visited.

I believe this will be a real convention—one in which the foundation work of our institution, the education and general uplift of these members, will receive the attention that so important a question deserves, and in order that this may be accomplished, certain days have been especially assigned for pleasure and others for business, and I hope that every delegate and as many of the members as can possibly do so, will attend and actively participate in all sessions of the convention.

The following program has been outlined, subject to change:

Monday, June 14th, 8 P. M.—Opening exercises of the fair, in which there will be an address of welcome by the Mayor and an invocation by the Rev. Wm. Rader. The fair will be started by the pressing of a button by the Mayor.

Tuesday, June 15th, 9 A. M.—Opening of the convention. 2 P. M.—Convention in session. 8 P. M.—Lecture on fans and ventilation, by R. B. Guernsey, M. E.

Wednesday, June 16th, 9 A. M. Sight-seeing trip. 8 P. M.—Lecture by W. F. Durand, engineer of the Department of Mechanical Engineering, Leland Stanford Jr. University.

Thursday, June 17th, 9 A. M.—Convention in session. Afternoon rest period.

Friday, June 18th, 9 A. M.—Sight-seeing trip. 8 P. M.—Theater party.

Saturday, June 19th, 9 A. M.—Convention in session. Noon—Convention adjourns. 8 P. M.—Banquet.

Extending to all delegates and friends on behalf of the Association in San Francisco our heartiest good wishes, I remain,

Yours fraternally,

H. D. SAVILLE, State President.

LIST OF EXHIBITORS AT THE MECHANICS' FAIR.

We give below a complete list of the exhibitors with the number of the booths they will occupy at the Mechanics' Fair to be held at the Auditorium, Page and Fillmore streets, San Francisco, from June 14th to June 19th, inclusive, under the auspices of the National Association of Stationary Engineers, and in connection with the annual convention which will be held during that week by the Association.

Exhibitor.	Booth No.
Allis-Chalmers Co.	227, 228.
Bird-Archer Co.	265.
Brooks-Follis Electric Corp.	96, 97.
Bowers Rubber Co.	104, 105, 106.
Boyd & Moore	93.
Braun, Knecht & Helman Co.	12.
Byron Jackson Iron Works	100, 101, 102, 103.
Callahan Co., John	123.
California Compounding Co.	7.
California Hydraulic Engineers.	126, 174, 175.
Cook Belting Co., H. N.	191, 192.
Compressed Air Machinery Co.	196, 197, 259, 260.
Crane Company	134, 135, 165, 166.
Cyclops Iron Works	215, 240.
Doak Gas Engine Co	208, 209, 245, 246, 247.
Dearborn Chemical Co.	189, 267.
Dow, Geo, E. & Co.	211, 212, 213, 242, 243, 244.
Dunham, Carrigan & Hayden Co.	1.
Earnst & Fearis Brazing Co., Wm.	80.
Eccles & Smith Co.	184, 185, 186, 187.
Fairbanks-Morse Co.	198, 199, 200, 257, 258, 256.
Fess System Co., Inc.	226, 229.
Fuller Co., W. P.	131.
Garlock Packing Co.	172, 173.
General Electric Co.	119, 120, 181, 182.
Greenbergs' Co., M.	22.
Herzog & Dahl Co.	201.
Henshaw, Bulkley & Co.	214, 241.
Harron, Rickard & McCone.	250, 251, 252.
Gorham Rubber Co.	107, 108.
International Chain Saw Co.	202, 203, 253, 254, 255.
Johns-Manville Co. H. W.	8, 9.
John Finn Metal Works.	125, 176.
Johnson Co., F. H.	132.
Kalas & Bennett Co.	79.
Keystone Chemical Co.	13.
Krogh Mfg. Co.	205, 206.
Lally Co.	15, 16, 17, 18.
Lord Co., Geo. W.	216, 239.
Lukenheimer Co.	178.
Marshall-Newell Supply Co.	94, 95.
Mechanical Dust Suction Co.	109, 110, 111.
Moore, Chas. C. & Co.	6, 121, 180.
Messe-Gottfried Co.	248, 249.
Moorehead Mfg. Co.	11.
Motor Car Service	204.
Moulthrop & Elsasser	10.
New York Belting & Supply Co.	138, 162.
Phoenix Tool and Valve Co.	179.
Pacific Suction Cleaner Co.	137, 163.
Power Specialty Co.	127.
Plant Rubber & Supply Co.	193, 263, 264.
Pacific Hardware & Steel Co.	150, 151.
Pacific Coast Rubber Co.	133, 167.
Paraffine Paint Co.	128.
Pacific Tool & Supply Co.	4.
Reynolds Third Rail Co., Inc.	81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92.
Selby Smelting & Lead Works.	2.
Simonds Machinery Co.	124, 177.
Squires & Byrne Co.	190.
Staples & Pfeiffer Co.	112, 133.
Sterling Rubber Co.	23, 24 26.
Superior Cereal Food Co.	34.
Tay Co., George H.	28, 29, 30, 31, 32, 33.
Tubbs Cordage Co.	144, 156.
Union Brewing Co.	188.
U. S. Flexible Metalic Tubing Co.	266.
Wagner Electric Co.	129, 130, 170, 171.
Westinghouse Air Brake Co.	118, 183.
Westinghouse Electric Co.	116, 117.
Whittier & Coburn Co.	122.
White Company (Auto).	3.
Witt, G. E. & Co.	168, 169.
Western Electric Co.	136, 164.
Western Saddlery Co.	98, 99.
Woodbury, Geo. E.	223, 224, 225, 230, 1, 2
Worthington, H. R.	26, 27.

HEATING AND VENTILATION.[1]

BY R. B. GUERNSEY, M. E.

To a great majority of prospective buyers, a blower is a blower, and on account of the inexperience of both the user and dealer, the blower selected is frequently not of the right type to do the work expected of it, and while I cannot hope to give you a detailed classification, in a paper of this nature, I have tried to cover the ground along general lines, and trust that the details most interesting to you will be brought up for discussion at the time of reading, since this is the idea in publishing the paper beforehand.

There are five general types of the centrifugal blower and, as each type has its particular field of work, we will start with a general classification and application.

The first type is known as a volume blower, usually made with a cast iron shell and steel plate wheel. The efficient pressure limit of this type is

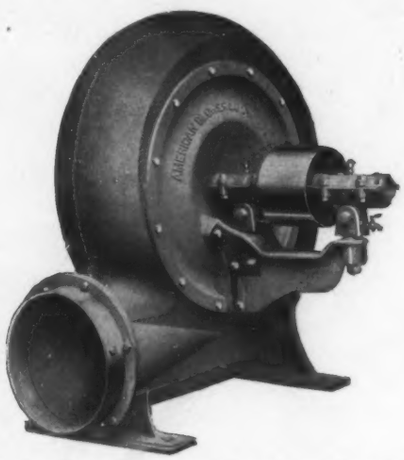


Fig. 1. Volume Blower for Forges or Furnaces Burning Coal or Coke.

4 oz. corresponding to a peripheral velocity of approximately 11,700 ft. per minute. This type should be used for supplying blast for blacksmith forges or furnaces burning coal or coke, and is used for various applications, where volumes of from 200 to 5000 cu. ft. per minute at from ½ to 4 ozs. in pressure are required.

This type is also made as an exhauster, and as such follows the same laws as the blower. The only difference between a blower and an exhauster is that the bearings on a blower are on either side of the shell and air is drawn into the blower from both sides. The exhauster bearings are on one side, the wheel being overhung and air drawn in through one opening. An exhauster can be used as a blower but a blower cannot be used as an exhauster. Used for exhausting fumes, lint from buffing wheels, emery from emery wheels and for drawing shavings from individual machines in woodworking plants, a custom being adopted by a number of the larger mills.

The next type is designed along the same lines, the case and wheel being made of heavy steel plate. This is used principally for exhausting shavings from a series of woodworking machines. Also used in other applications requiring volumes of 1500 to 28,000 cu. ft. air per minute at pressures of from ½ to 4 ozs.

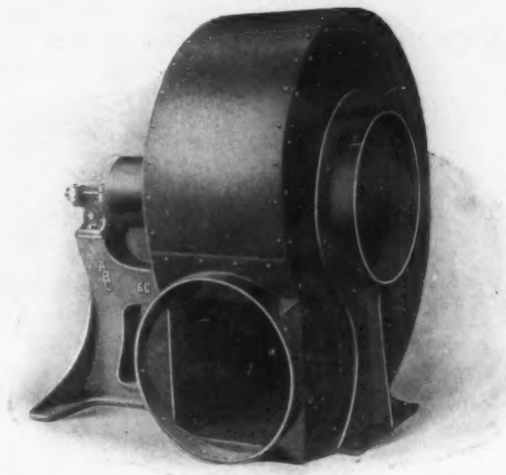


Fig. 2. Volume Blower for Use in Connection with Wood-Working Machinery.

The next type, known as a pressure blower, is practically a continuation of the volume blower and is designed for maximum pressures of 16 ozs. per sq. in. corresponding to a peripheral velocity of about 22,000 ft. per minute.

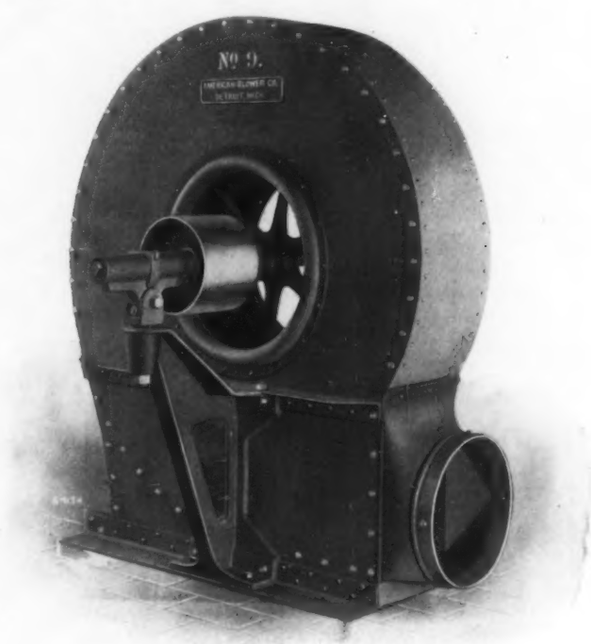


Fig. 3. Volume Blower for Cupola and Oil Furnace Work.

Used largely for cupola and oil furnace work. Some manufacturers make this type with a cast iron shell, although a steel plate shell is far better for the reason that the shell is under a heavy strain owing to the high speeds, and a light external jar will frequently break the shell if made of cast iron.

A type entirely different from either of the above is the disc fan, designed for handling large volumes of air at low pressures, ¼ oz. or under.

[1] Paper prepared for N. A. S. E. Convention, San Francisco, June 14-19, 1909.

This type is used for ventilating, removing fumes or dust from rooms and for various installations where

Fig. 4. Disc Fan for Handling Large Volumes of Air at Low Pressures.

the air to be handled is carried but a short distance and at low velocities.

The next type, with which you are probably more familiar, is known as the steel plate fan.

Fig. 5. Steel Plate Fan for the Ventilation of Buildings, Mines, Etc.

This is virtually a large size volume blower, since the maximum economical pressure is 4 oz. per sq. in., and the capacity is almost unlimited. This is the type generally used for the ventilation of buildings, mines, etc. To present these types in a comparative form we have:

Volumes under ¼ oz.		Disc fan
Small	volumes ½ to 4 oz.	Volume blowers or exhausters
Small	volumes 4 to 16 oz.	Pressure blowers or exhausters
Medium	volumes ½ to 4 oz.	Steel plate exhausters
Large	volumes ¼ to 4 oz.	Steel plate fans

Inasmuch as the term "pressure" is rather misleading, it might be well for us to arrive at a general understanding of this term. The same two forces are at work in the discharge from a fan, as are at present in all mechanical problems, namely, "dynamic" and "static" forces, which we designate as "dynamic pressure" and "static pressure." One is always working against the other, with the result of practically producing a third pressure which we call "air velocity pressure," and which is represented by the difference of the first two pressures.

The pressure and movement of the air is due entirely to the centrifugal force produced by the air sliding off from the fan blades, and the centrifugal force is in direct ratio to the square of the revolutions. With a fan wheel of given proportions the centrifugal force holds a direct ratio to the peripheral velocity.

It is quite evident that when the term "pressure" is used as applied to the centrifugal fan that the term implies velocity and that it is a kinetic and not a potential pressure. This is a distinction that is frequently overlooked by engineers and in many cases has resulted in a practical failure of the apparatus.

If you will always remember in dealing with work of this nature, that a cubic foot of air has its greatest velocity at the instant of leaving the fan tips and can not regain this velocity again—always decreasing due to overcoming friction, you will not make the error so frequently made, of decreasing pipe sizes in order to "increase the pressure."

A good rule to follow is to increase the diameter of a delivery or suction pipe ½ in. for each 100 ft. in length over the diameter of the inlet or outlet of the fan, as the case may be.

For example, we want to deliver 1000 cu. ft. of air per minute through a pipe 800 ft. long. For this we would use a fan with a 7-in. outlet. By the above rule a pipe 11 in. in diameter would be the proper size. The reason for this is that a long run of pipe offers considerable resistance to the flow of air, thereby cutting down the capacity of the fan, and as this resistance varies as the square of the velocity, it is evident that by increasing the area of the duct, we decrease the velocity, therefore the resistance, and increase the capacity of the fan.

The capacity of any fan varies directly as the ratio of blast opening or expressed differently as the ratio of resistance, or ratio of opening in the discharge as compared with the total discharge area. As an example, a given fan when running at 200 turns will handle 20,000 cu. ft. of air per minute requiring 5 h. p. under conditions such that the inlet and outlet are unrestricted. We now place 500 ft. of galvanized pipe on the outlet, and made the same size. The fan running at 200 revolutions will deliver at the end of this pipe approximately 15,000 cu. ft., and since for all practical applications the h. p. also varies directly as the capacity, or blast opening, the h. p. required will be

$\frac{15}{20} \times 5 = 3.75.$

You can easily see why it would be impossible for manufacturers to publish capacity tables that would be reliable under all conditions. The more conservative manufacturers rate their fans on about 75 per cent blast opening, and issue catalogue tables on this basis, which is a very safe figure, while others persist in rating on the basis of 100 per cent opening. This accounts for the wide discrepancies in the capacity and h. p. for a given size fan as catalogued by different

manufacturers.

In order that you may have some idea of what you are buying, the following data will enable any of you to check up the size of fan that you will require.

We will assume that 20,000 cu. ft. of air per minute are required for ventilation. A pressure of ½ oz. per sq. in. is ample velocity for this class of work, and is sufficient to overcome the friction in a series of ducts under any normal condition. We know by experience that a peripheral velocity of 4120 ft. per minute is inside the noiseless limit and at 75 per cent opening will produce a static pressure of ½ oz.

The blast opening or equivalent area of the fan is given by multiplying the diameter of the wheel by the peripheral width divided by a constant, expressed as $\frac{D \times W}{C}$ = Bl. Area. C being determined from experimental tests and varying with different percentages of openings. In this case it is 2.8 for 75 per cent opening. Blast area multiplied by peripheral velocity must equal the capacity of the fan.

$$\text{Therefore } \frac{20{,}000}{4120} = 4.85 \quad \text{blast area.}$$

We now assume a diameter of wheel in this case 6 feet.

$$4.85 = \frac{6 \times w}{2.8}$$

$$w = \frac{4.85 \times 2.8 \times 12}{6} = 27\tfrac{1}{4}''$$

The wheel would therefore be 6 ft. in diameter, 27¼ in. peripheral width, and would be housed in a

$$\text{No. 120 fan, would run at } \frac{4120}{6 \times 3.1416} = 219 \text{ r. p. m.}$$

$$\text{and would require } \frac{20{,}000 \times 5.2 \times .866}{33{,}000 \times .4} = 6.8 \text{ brake h. p.}$$

We will now take up the application of the fan.

Probably the first problem that confronts the engineer in laying out a heating and ventilating system is what amount of air will be required for complete ventilation. Unfortunately there is not a fixed standard for basing our calculations, although the present day standard seems to be based on the amount of money that the owner will pay for the system, and after this amount is decided upon a system is then designed to approximate these figures.

The writer believes that the old rule of 30 c. f. m. per person, which is universally used as a standard for school ventilation, is a very safe one to use under any normal condition. This will probably have to be increased 20 to 25 per cent for rooms where smoking is permitted, and 20 per cent for hospitals.

Ventilation is a process of dilution of the impure air in a room by the admission of fresh air, and a room is properly ventilated in the opinion of hygienists when the dilution is such that the CO_2 (carbonic acid) in the air does not exceed 6 to 8 parts by volume in 10,000. Air varies from 4 parts CO_2 to 80 parts per 10,000, depending on where it is taken from.

Basing our calculations on the assumption that the average city air contains 4½ cu. ft. CO_2 per 10,000 cu. ft. air, and that the limit allowed in a room is 8 parts, we have—

$$M = 10000 \left[\frac{Q \times E}{10000} + .6 \right]$$

[As per report dated March 16, 1882, of a commission appointed to examine public schools in District of Columbia.]

$$\text{Then } \frac{Q \times E}{10{,}000} + .6 = \text{cu. ft. } CO_2 \text{ liberated in room in 1 hr.}$$

This value divided by Q and multiplied by 10,000 gives the proportion of CO_2 in 10,000 parts of air in the room, and this should equal M, the standard of purity desired.

$$Q = \frac{6000}{M\text{-}E} = \frac{6000}{8\text{-}4\tfrac{1}{2}} = 1710 + \text{cu. ft. per hr.}$$

Q = cu. ft. to be supplied to each person.
E = cu. ft. of CO_2 in each 10,000 cu. ft. admitted.
M = max. amount of CO_2 that each 10,000 cu. ft. can contain.
6 = cu. ft. CO_2 exhaled per person per hr.

While this appears to be a very flexible rule, I believe it a far better and more certain basis to work on than the common method of assuming a periodical air change, and inasmuch as the maximum seating capacity of any room or building can be easily estimated, the rule can always be used, with the one exception of stores, where people are constantly going in and out.

For this class of building the quantity of air is determined by the air change method—usually four times an hour for low ceiling, two or three times an hour for high, depending on the amount of exposed surface. So much for the quantity of air. The next step is how to convey this air from the fan to the several outlets. Again we have no fixed rule. The simplest method is to figure on a velocity basis, and as the distributing mains of practically all installations consist of ducts, or horizontal runs and flues or vertical risers, we can figure on the following basis:

Main ducts	900 to 1200 f. p. m.
Branch ducts	600 to 1000 "
Flues	400 to 600 "
Register faces	200 to 350 "

While these are not arbitrary values, they will be found to work out very well in practice. It is well to remember, however, that more mistakes have been made by trying to drive the air too fast, than were ever made by having it move too slowly.

The proper size of duct, flue of register face is

$$\text{arrived at by the formula } \frac{\text{a. p. m.}}{V} \times 144 = \text{free area in}$$

square inches.

Hot air registers are usually placed 8 ft. from the floor, vent registers at the floor line. In rooms where

smoking is permitted, a vent face should be placed near the ceiling in addition to the floor face. This allows the smoke to be taken out without drawing it back to the floor line.

A simple arrangement is to have both vent dampers operated by one cord and as one is closed the other is opened. The average register face has about 1/3 of the inside area obstructed and it is therefore good practice to add 50 per cent to the free area to determine the total area required in the register.

Vent registers, flues and ducts should have the same area as the heat flues and registers, and if a single fan system is installed they had better be designed 10 per cent greater.

This is on the same principle as filling a barrel with water. This barrel has a 2-inch pipe under 10 pounds pressure supplying it with water, which can flow freely through a 2-inch bung hole. One would perhaps think that the water would flow out as fast as it flows in—nevertheless you can fill the barrel to overflowing. If the vent flues are amply large the results obtained in reducing the percentage of carbon dioxide (CO_2) will be far better and the system will work easier.

Do not attempt to ventilate a building without heating the incoming air. You would not think of blowing cold air into a room and, for the same reasons, do not draw the hot air out, expecting the room to remain comfortable, unless the entering air is warmed. I have noticed buildings heated throughout with direct radiation, with a big exhaust fan installed capable of changing the air three to six times an hour, and the occupants have wondered why they could not keep the rooms warm. Cold air must leak in to replace the air exhausted, and if air is allowed to leak in through a dozen different places, it is impossible to prevent drafts in the room. The plenum or pressure system is the better way to ventilate, and if properly installed there is absolutely no necessity for installing direct radiation in rooms heated by this system. This suggests another much discussed point—single versus double fan system.

The ideal system is necessarily the combined plenum and exhaust system, on account of its flexibility and positive operation. However, if finances will not warrant a layout of this nature, by all means eliminate the exhaust fan, and not the plenum fan. I might add here that a perfect fan system must include some system of temperature regulation. It should be positive in its action and so sensitive in its control that it will hold a given temperature in a room within 1 degree of the required temperature. The principle is based on the relative expansion of different metals—in conjunction with compressed air for power. However, the same rule would apply here as previously given—better have a fan system without this control, than no system at all.

Toilet and kitchen ventilation is of sufficient importance to consider apart from the general subject. I am speaking now of a class of buildings such as hotels, restaurants, schools, etc., where the toilets are large enough to require some provision for ventilation.

If possible, install a separate fan for this work. A small disc type of fan and direct connected motor is the best arrangement for one or two rooms and this can be placed in the wall, or a flue can be carried to the roof and the fan located there.

Never blow air into a toilet, as there will be enough leakage into the room, sufficient for ventilation, provided a fan is installed for drawing the air out. In other words, a toilet should be under a vacuum and not a pressure.

Unless a kitchen is very large the same thing applies. The best method of getting smoke and steam out of a kitchen is to construct hoods over the ranges and steam cooking kettles and collecting the gases in these hoods before they become diffused through the room, and when exhaust fans of proper size are connected to these hoods by means of G. I. pipes, a positive removal of these gases is assured. These hoods should not be less than 6½ ft. from the floor on account of tendency to deflect the heat, making it very uncomfortable to work under them.

In very large kitchens so much air is exhausted that it becomes necessary to heat the entering air, on account of cold drafts, and this is accomplished either by a regular heating plant, separate from the main plant, or a branch duct can be carried to the kitchen from the central apparatus. Always be certain, however, that the exhaust system is capable of drawing at least 20 per cent more air out than is blown in, thereby keeping a vacuum in the kitchen and preventing fumes from working through the building.

We can safely establish the rule that kitchens or toilets must always be ventilated by an exhaust fan and preferably individual fans, although this is not absolutely necessary.

Restaurants and smoking rooms should always have a double fan system on account of the smoke. It is always preferable to place exhaust registers as near the ceiling as possible, in order to draw the smoke out before it becomes diffused through the room.

If possible, locate the vent and hot air registers on opposite sides of the room, so that the air is drawn across the room carrying the smoke with it.

I believe the average engineer is not interested in the design of the fan, heater, coils, etc., beyond the point of getting the best in the market at the lowest cost, although he should know the essential features of heating and ventilating apparatus in order to choose the best, and I will endeavor to point out some of these features.

Probably the most important part of an apparatus is the heating coil. Quite a few of you have likely had trouble with heating coils in heating and ventilating system that you have installed and, as there are but two distinctive types of pipe coils on the market, I will try and point out the advantages of one type over the other. To start with, let us consider some of the physical properties of steam.

One lb. of steam under 5 lbs. gauge pressure has a volume of 19.72 cu. ft. and has a temperature of 227°. 1 lb. of water at atmospheric pressure has a volume of .0166 cu. ft. Therefore 1 lb. of steam occupies a space 1200 times greater than 1 lb. of water, under the above average condition in a heating coil. In heating a given quantity of air, by passing over steam coils, from 32° to 106° F. at a velocity across the coils

of 1000 ft. per minute (which would be a fair case for San Francisco climate). 0.6 lbs. of steam would be condensed per lin. ft. per hour. With this rapid rate of condensation, it becomes necessary to build a coil that is absolutely positive in circulation, so that the flow of steam is in one direction without any possible chance of meeting an opposing pressure, which would naturally tend to check this flow.

The American Radiator Company has perfected a cast iron coil known as "Vento Radiation," with which you are probably familiar.

On account of the vento being made entirely of cast iron, it is free from liability of rusting or corroding, and since practically all pipe coil heaters are made of a semi or mild steel pipe, this anti-rust feature is worthy of considerable notice. From the contractors' standpoint it is easier to handle and as a usual rule costs less to install than pipe coils of equivalent heating surface, and its efficiency as a heating agent is about equal to the average pipe coil. Therefore, I believe this type of coil will in time supplant the pipe coil for low pressure work, just as the cast iron radiator has supplanted the pipe radiator.

See that the fan is built of heavy plate well braced to prevent sides from vibrating, that the boxes are self-aligning, ring-oiling type and the wheel is properly balanced.

Allow me to make a suggestion to you bearing on the commercial side of the heating and ventilating installation. Instead of specifying sizes of fans, motors, heating coils, etc., specify the amount of air required per minute, the maximum velocity of fan tips, and the temperature desired.

(As stated before, a peripheral velocity of 4120 feet is always well inside of the noiseless limit.)

Then call for apparatus to be furnished of sufficient capacity to produce these quantities under a guarantee sufficiently exacting to prevent fraud.

This insures you the highest grade product at a minimum cost, for the reason that the better the grade of apparatus the more efficient it is.

The specifying of a certain size fan does not insure you the results desired, for the reason that engineers and architects are dependent on fan manufacturers to a more or less extent for fan performance tables.

The manufacturer of necessity must make these tables on the safe side and, for this reason, a fan sometimes two sizes smaller, if properly designed, will accomplish the desired results.

Manufacturers of fans, as a rule, have spent considerable time and money in developing laws covering their performance, and should be prepared to back up their figures by guarantees sufficiently strong to insure you of proper results, provided the selection of sizes is left to them.

To state the matter more clearly, it is just as possible to design a fan which will handle a given amount of air, requiring a certain h. p., as it is a steam engine to give a certain h. p. output with a given steam pressure, and while it is not generally conceded, the engineering part of this business graduated from the guessing stage long ago. It is true that local conditions affect the fan output considerably more than the engine, but it is possible to determine the actual performance of a fan to within ½ to 1 per cent, before its installation, and this has been accomplished in numerous instances in order to demonstrate the reliability of formulae. However, in handling the matter this way, you must insist on tests being run after installation in order that you may be protected.

There are several methods used for testing the output of a fan, the most common way being the use of an anemometer. In using this instrument, care must be exercised in getting a fair average, and not basing the total output on the velocity recorded in one or two positions on the outlet or register. With a 4-inch wheel anemometer, ½ minute readings should be taken every 6 inches, both vertical and horizontal, and these readings averaged up. This result multiplied by the total free area of the outlet or register will give the cu. ft. of air per minute flowing through the outlet.

For very accurate readings a pitot tube is used, similar to that used in hydraulics; which will give readings in inches of water gauge corresponding to certain velocities.

This method is quite complicated, involves special apparatus and requires considerable time, and therefore is seldom used where approximate results satisfy.

You understand, of course, that a heating and ventilating plant must, of necessity, be designed to suit the building; hence we seldom find conditions twice alike, and you can readily appreciate the impossibility of incorporating in a paper of this nature, any but the broadest of statements. If I have gone into this matter deep enough to rouse your curiosity as to the possibilities of the fan and its application to buildings, I shall feel greatly encouraged.

I believe we have just passed from the luxury into the necessity stage in regard to mechanical ventilation, since it is coming into general use more and more, and I believe the engineer should use every possible argument in favor of it, never losing sight of the fact that a ventilation system is as necessary in a building as a pair of lungs in an animal.

TELEPHONE SERVICE ON SPECIAL TRAIN.

Electrically lighted trains have become so well known to the traveling public as to excite little interest or comment, but trains fully equipped with telephone service between cars, and with a regular exchange, is something entirely new in the way of innovations, especially on the Pacific Coast, where such an equipped train has never been seen. The hundred representative Californians who will go on the California Promotion Committee's visit to the Alaska-Yukon-Pacific Exposition this week will travel on a train the special feature of which will be this telephone service.

The Pacific Telephone and Telegraph Company will provide the equipment, which will require an expenditure of more than $1000, and will have two of its best operators to work the exchange, which will be in operation day and night.

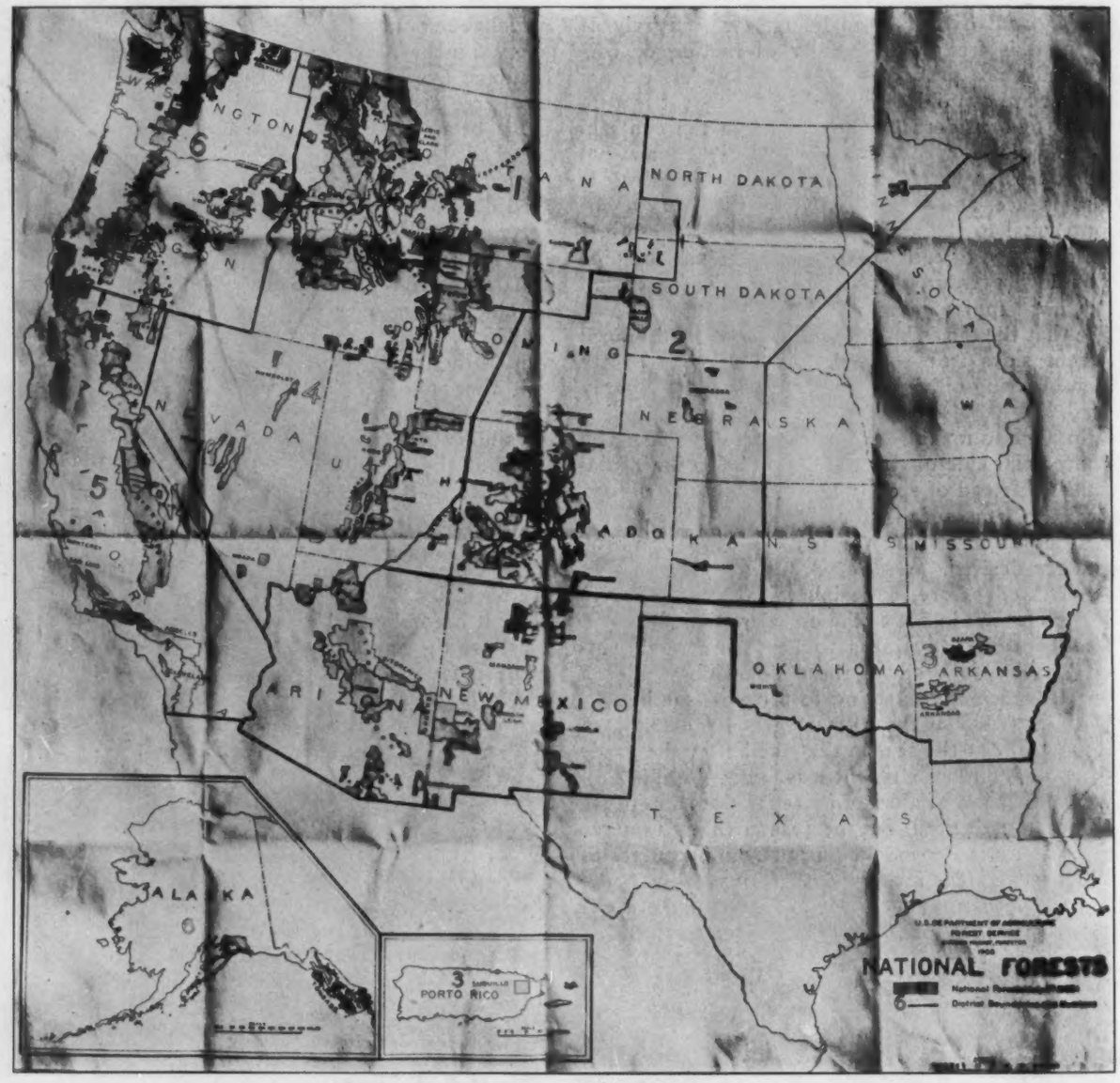
On arrival at Seattle the train will be parked at the exposition grounds, and will be the home of the members of the party while there. Connection will be made with the Seattle central telephone exchange with four or more trunk lines, and the train will be in constant telephonic communication with all parts of that city and with long-distance service.

USING THE TELEPHONE TO FIGHT FOREST FIRES.

BY CHARLES L. MULLIGAN.

The season for forest fires is about to commence. The early summer months with their days of heat and drought invariably bring with them destruction to acres and acres of timber tracts that this country can ill afford to lose. Dr. W. J. McGee, the Government's erosion expert, estimates the aggregate loss from this source, taking in all parts of the country, at no less than a million dollars a day during the dry spell. Last year the fires were worse than ever. Everybody can recall the daily reports of towns wiped out, lives lost and thousands of square miles of precious woodland wasted. It amounted to nothing less than a public calamity. The terrible visitation formed part of the subject of President Roosevelt's famous message on the conservation of natural resources. If the fertility of American soil is not to suffer, surely something must be done to guard against another devastation like that of 1908, he argued.

For the loss is not alone to the tracts of wooded land laid waste. The character of an entire countryside is changed by such a conflagration. Many have passed through portions of various States and seen the awful effects of a forest fire—the blackened stumps it leaves behind, the dreary waste of sterile, unproductive land.



Area and Location of National Forests.

Not only is timber burned up, but the loss of foliage has a destructive effect on the atmosphere. The development of streams, upon which the country relies for power, and which forms the distinctive feature of all American landscapes, is arrested. The indirect loss which accrues when forests are burned would be pretty hard to estimate.

Uncle Sam, of course, knows this, and it is interesting to see what has already been done to prevent further loss. The Government exercises sway only

over the national forests, principally in the far west. Here prodigious steps are being taken to safeguard the timber lands from destruction. Principal among the preventive measures is the use of the telephone. Already this common little instrument has succeeded in arresting the progress of several serious blazes, and the experts of the Department of Agriculture are eagerly watching for more proofs of its efficiency.

In the national forests in 1908 lands extending 414,638 acres were burned over. The timber destroyed aggregated 232,191,000 board feet. There is food for thought in these figures. As much lumber as was utterly destroyed last year would build many a good sized town. Cut into planks of the accepted dimension, one inch thick and one foot wide, and laid end to end, it would extend almost twice around the earth. And this, too, in the national forests alone—only the thousands of individual lumbermen whose private interests suffered could furnish any information that would involve a real total.

The Forest Service atlas figures that in the year 1906-7 for every thousand acres of national woodland, .92 acres were destroyed by fire. In the preceding year 1.078 acres per 1000 were burned over. But in the past year, with a report of 414,638 acres destroyed out of a total of 150,831,665 acres of government forest land, including alienations, it can be computed that 2.74 acres out of every thousand were wiped out.

Fires in the forests have their origin in many causes. In the summer months dry leaves and brittle stumps are prolific sources of trouble. The least spark thrown into a pile of woodland rubbish may start a tiny flame—the blaze, invisible for days, perhaps, will smoulder until suddenly it breaks out and seizes tree after tree.

It is possible to avoid one species of risk, and here New York has set a notable example. The Public Service Commission for the second district of the Empire State has directed an important ruling at the railroads. The second district includes all of the State without the boundaries of the city of New York—and there are no woods in Gotham, unless one considers the park trees. The New York State railroads last year were found to be the cause of 83 serious blazes, most of them in the Adirondacks. Sparks from locomotives did the damage. Accordingly the Hughes commission, after an inquiry into the facts, has ordered that oil be burned as fuel in locomotives on all roads traversing the wooded lands between April 15th and November 1st of each year.

The foresters wish it were as easy to regulate hunters, who cause more trouble than railroads. New York reports that last year 103 fires of large dimensions were caused by the carelessness of amateur sportsmen. Fifty thousand acres of trees were burned down. The hunter who builds his camp-fire in a clearing and goes away without stamping out the remains; the man who knocks the hot ashes out of his pipe by hitting it against a tree-trunk, and the one who throws his cigar-end off into the bushes at his side little realize what follows in their wake. Probably, if told they were the cause of the great conflagration they see a few days later, they would be astonished.

Quite a few of these fires are started by incendiaries. The fiend who sets the torch to a forest differs very little from his brother, who explodes a bomb in a tenement. Thoughtless children are known to have been the cause of some fires. Still a larger number go unexplained. What to do to check the spread of the flames is a more pressing problem to the government than how they started.

In the national forests are about 200,000 men ready to turn out and fight the flames whenever necessary. This includes regulars and volunteers of all descriptions. During the forest fire season the United States Forest Service employs 1351 rangers and guards. Each man has a certain beat to patrol. Taking into consideration the area of the national forests, it can be calculated that each of these "patrolmen" covers 121,506 square miles. Quite a long beat for a man, even on horseback.

Using Portable Forest Telephone.

This is where the telephone comes in. Portable telephones are made expressly for this purpose, and with their aid each ranger is kept in touch with his entire area. Let a fire start, and immediately the wires ring with the message of warning. Strapped to the back of the ranger, the telephone is an ever-present and quicker-than-lightning messenger. It has worked wonders lately, and it means almost the only encouragement for those engaged in the apparently hopeless task of combating the forest fires.

In one case last year a government officer summoned help from 43 miles away with his portable instrument. Aid was received more than a day sooner than if a messenger had been dispatched.

Forester Gifford Pinchot's latest report on this subject is dated June 30, 1908. During the year previous to that day 3500 miles of telephone lines were

constructed in the national forests. This year's report will show interesting data. The work has been progressing as rapidly as appropriations would permit, and the number of telephones has been greatly increased. Already this year 2523¾ miles of telephone lines have been constructed.

Portable Telephone Set.

Government telephone lines have been built in Arizona, California, Montana, Nebraska, New Mexico, Oklahoma, Oregon, Utah, Washington and Wyoming. The need of phones has not been underestimated in the past and many miles of telephone line have been constructed in the national forests. The headquarters of many of the forest officers are in isolated parts of the country and in some cases it takes three weeks for an answer to be received to a letter, although the distance may not exceed 60 to 70 miles.

To talk of eliminating forest fires is nonsense, everybody knows that. But if the success to which they may be fought shows a greater percentage through the use of the telephone the Forest Service will feel justified in the expenditure it has made. With the season coming on fast, the men in the woods will find their phones more than useful.

One of these portable telephones is an interesting instrument. The case is handsomely finished in birch or mahogany and is provided with a strap to facilitate handling. It contains a buzzer, hand generator, switch, receiver cord, one dry battery, induction coil, a transmitter and a receiver.

The transmitter is fastened inside the case and the receiver and the other projecting parts are mounted so that they are not likely to be caught by branches. The compactness of the set makes it easy to handle.

OBJECTS OF NATIONAL IRRIGATION CONGRESS.

The primary objects of the Congress are to save the forests, store the floods, reclaim the deserts and make homes on the land. It is purposed to demonstrate to the West the possibilities of this development and to show to the East and South the importance and value of this work to the entire country.

The economic value of irrigation whether by Government project or private enterprise, cannot be measured in dollars and cents. It is a confirmed success from financial and commercial viewpoints, and economists declare that the development of the Western country will provide a safety valve against the impending dangers of congestion in the cities of the East.

WIRELESS TELEGRAPHY ON BOARD SHIP.

BY MAURICE CHILDS.

Even in these days of new discoveries the invention and application of wireless telegraphy stands in the front rank as one of the greatest achievements of modern science. Improvements have followed one another in rapid succession, and indeed wireless electrical transmission has become the fashionable theme of the inventor and scientist. The great progress of Hertzian wave telegraphy has been due almost entirely to the immense service it has rendered to shipping generally; the merchant is no longer cut off from the outside world during voyages from continent to continent; not only is he in constant communication with his business on shore, but he is able to enjoy the luxury of his daily newspaper.

The value of radio-telegraphy to the shipowner cannot be overestimated; the position of a ship fitted with the modern telegraph can be accurately followed and her time of arrival fixed with far more certainty than before its adoption. Passengers now travel with a greater sense of security, knowing that if accidents should happen the flashing of the distress signal, viz: "SOS," would bring ships from all points of the compass rushing to the aid of the disabled boat. The recent event where the lives of the passengers and crew of the S.S. Republic were saved by wireless telegraphy from almost certain death, is still fresh in the minds of everyone; this is, however, but one of the many incidents in which help has been obtained through this medium, and it is safe to say that ere long the fog at sea, which is so disastrous to shipping, will lose many of its terrors when mariners by the aid of wireless will be able to locate the exact position of their own and that of other vessels in the immediate vicinity. The time may also not be far distant when the inefficient methods of signaling by means of flags will be superseded by the more practical and infinitely superior method of wireless telegraphy.

With quite a small installation a range of fifty miles is easily obtained. At the present time there are several more or less known systems suitable for ships, which have been thoroughly tested and proved reliable.

It may be of interest before going further to recount a few of the early experiments which were carried out by Mr. Marconi and others. Prior to the year 1896, when Mr. Marconi first brought his historical "secret box" to this country, Sir William Preece, F. R. S., had been engaged in some very interesting and successful experiments in wireless telegraphy between Rathlin Island and the mainland. The distance covered was approximately two and a half miles, and for a considerable time the apparatus was used by the military authorities.

The system had, however, serious limitations, which can easily be comprehended when it is understood that in order to signal over a given distance it was found necessary to stretch two telegraph lines parallel and opposite one another, each wire being equal in length to the distance between the stations. On the advent of Mr. Marconi in England further experiments in the above system practically ceased. Sir William Preece quickly perceived the enormous advantages of the former's apparatus and its modus

operandi, and at once interested himself in its further development.

In the light of present-day knowledge one is apt to forget the work of the pioneers, but it is a generally recognized fact that but for the kindly assistance of Preece, not only personally, but also officially, Marconi's system would not have held the position it does to-day, either technically or commercially.

The most important of Marconi's early experiments were those carried out between Bournemouth and the Needles, a distance of ten miles. These took place in the year 1898, and it is interesting to note that in these tests the signalling speed was something between three and four words per minute. Subsequently these stations were removed to Poole and St. Catherine's Point respectively.

In 1899 Marconi established wireless communication across the Channel, between the South Foreland Lighthouse and Wimereux, near Boulogne, and at this time public excitement about the new method of telegraphy was at its zenith.

On Dec. 12, 1901, Marconi received signals across the Atlantic at St. John's, Newfoundland, from a large station at Poldhu, in Cornwall. This station was principally designed, so far as the plant was concerned, by Dr. J. A. Fleming, M. A., F.R.S., whose contributions to electrical science are well known.

It would not be fair in passing to omit mention of the experiments carried out in 1903 by Dr. Lee de Forest between Holyhead and Howth Point, in Ireland. Although the distance covered was comparatively short, considerable significance can be attached to these tests, since they demonstrated a very important fact, viz.—the possibility of two wireless stations of approximately equal power operating simultaneously without in any degree interfering with one another, since within two or three miles of the Holyhead station a Marconi installation was also exchanging messages with Atlantic liners carrying wireless installations.

Mention should also be made of more recent work, but as space is limited, the writer will content himself by giving results obtained during 1908 by the Amalgamated Radio Telegraph Company at their radio station at Cullercoats, near Newcastle.

By means of their latest and most perfected type of recorder, signals have been received at the above station from Lyngby, in Denmark, and printed at the rate of 100 words per minute.

In referring to the early work, the object has been to show how this system of communication has been improved from a technical point of view, and it is now to be shown what enormous advantages are to be gained from equipping vessels with this means of signalling.

Unfortunately, through the desire of interested parties to advertise particular systems of radio-telegraphy, the public have from time to time been apprised, through the medium of the daily press, of extraordinary feats, or better freaks, of communication which may have occurred from time to time but cannot be repeated, and is thus led into believing that vast improvements and developments are going to be made—beliefs which unfortunately have rarely, if ever, been realized by actual results.

This method of disguised advertisement has done much harm to this particular branch of science, since the investing public quickly tire—and rightly so—of hearing promises which have so persistently been unfulfilled, and the capitalist at the present time consequently regards with great skepticism any new and genuine system or improvement which may be brought out by some workers or inventors of unknown public repute, but who nevertheless possess great scientific attainments.

Nothing succeeds like success is the old adage; but how is success to be attained unless facilities are granted by those who can afford them? A very practical instance of the very apathetic attitude of certain classes of English shipowners is afforded by the following: About three years ago it was the writer's privilege to present a scheme to two or three companies owning large fleets of fishing vessels, for equipping some of their vessels with installations of wireless telegraphy apparatus. Among one of the advantages placed before them was the not inconsiderable one of adjusting the arrival of the fleet in port when the market prices were high. To be brief, nothing came of the scheme, but it is interesting to note that our neighbors the Germans have recently adopted practically the same idea, and a number of their North Sea fishing vessels are fitted with installations which appear to give every satisfaction, and answer the purpose for which they were required.

In order to give the reader better information regarding the actual possibilities of radio-telegraphy, a few facts concerning the apparatus employed and its capabilities may be of interest.

To commence with, the distance over which signals can be transmitted and received depends on several factors. The most important of these is the power used in the transmitter. The greater the power, the greater the distance. The distance, however, does not increase in direct ratio to the power employed.

Modern vessels of even quite small tonnage have electric light installations on board, and where this is the case, the telegraphic power may be obtained directly from this source. The normal power allowed for vessels under the regulations laid down in the International Convention of Radio-telegraphy, is one kilowatt or roughly 1 1-3 h. p. This power is sufficient to cover under all circumstances, with one exception, a distance of 200 miles. At times, this distance would be far exceeded, but we are not dealing with possibilities but actual facts. For distances less than the above, say 100 miles, ½ h. p. is ample, and normally considerably less than this can be employed. These figures are, of course, applicable only to communications over sea and not over land.

Other factors which determine the signalling distance are—atmospheric conditions, daylight effects, and the receiving appliances employed. Regarding atmospheric conditions the distance is immensely increased when a fog or sea mist is present—a fact, it should be noted, of a most advantageous character. Wind and rain make little or no difference to the transmission, although the latter may sometimes reduce the range owing to want of care on the part of the operator using the apparatus in the supervision of the plant and maintaining the proper degree of insulation of the radiating wire, or antenna, as it is

technically named. The influence of strong sunlight is to reduce the signalling distance, but this is to some extent nullified by the increase due to darkness. The reader should bear in mind, however, that the above figures represent the minimum distances under all these conditions.

Coming now to the apparatus itself, this can be divided into two classes—that used for transmitting and that used for receiving.

In the present state of the art it is not possible to send and receive messages at the same moment.

When the transmitter is in operation the receiver is temporarily disconnected and vice versa.

Transmitters again can be divided into two classes—those which can inter-communicate with all receiving apparatus adjusted to respond easily to them, and those which only affect instruments very delicately adjusted to them.

The former are termed spark transmitters and the latter arc transmitters.

For shipwork, the spark apparatus is undoubtedly the superior, both from a technical and practical standpoint, since it is obvious that inter-communication with all other stations is not only desirable but absolutely essential if the safety of the vessel is to be assured.

Hence, since the object of this article is to deal with radio-telegraphy on ships principally, only the spark form of transmitter will be discussed.

This part of the installation is the most complicated; that is, if any of it can be called complicated as compared with the other machinery now in use on modern ships. For small plants a battery of accumulators, consisting of eight to ten cells, charged from the electric light installation, and connected to the sparking instrument, technically called an induction coil, cannot be much improved upon. By the use of accumulators, placed in a part of the ship which would be least likely to sustain damage either by collision or storm, there is always a store of energy available for signalling in the event of the machinery in the engine-room being disabled. The provision of such auxiliary source of energy should be insisted upon by owners contemplating the equipment of their vessels.

For large powers, from ½ h.p. and upwards, a small rotary-converter is employed.

This machine is used in conjunction with a slightly different form of sparking instrument; in fact, the converter generates alternating current and supplies an ordinary high-tension step-up static transformer. This converter may be housed in any convenient corner, either on deck or just below, and is normally driven by current from the lighting installation, or in the case of failure due to accident, by current from accumulators, or in other cases, and if preferred, by a small petrol or oil engine.

There is another method of obtaining high-tension electric energy, which, although up to the present not in practical use, would appear to have advantages over existing methods so far as first cost and simplicity are concerned. It consists of forcing steam at a pressure of from 75 lb. to 100 lb. per square inch through specially constructed nozzles, the vapour subsequently passing through a well-insulated metal tank or box, in which a few metal points are inserted.

Owing to the friction of the particles of water through the nozzles, electricity is generated in considerable quantities and the tank or box becomes powerfully charged. This apparatus has been much improved recently, and the writer has witnessed pressures of 60,000 volts to 100,000 volts so generated and registered by a Kelvin electrostatic voltmeter.

By the use of this apparatus all converters, transformers, etc., can be dispensed with and the energy taken direct to the aerial conductor or other capacity. There is also a further advantage with this form of generator, in that there is absolutely nothing to get out of order and any marine engineer can effect the occasional renewal of the special friction pieces of the nozzles.

To return to the transmitters employed at the present time, the energy from the induction coil or high-tension transformer is led into a condenser. This condenser generally takes the form of a number of Leyden jars arranged in series or parallel according to the different systems. The use of this form of condenser is to be deprecated for two reasons. The first is the rapid deterioration of the metal surfaces owing to the formation of nitric acid when they are in use; and the second is the large amount of space which is occupied. Very compact serviceable oil condensers can be now obtained, and give little or no trouble.

It is the discharge of the condenser which gives rise to the Hertzian waves which are radiated into space from the aerial or antenna. The latter consists of from one to four or more conductors suspended from or between the masts of the vessel; these aerial conductors should be preferably of phosphor-bronze wires on account of its strength and durability.

In order to set up the waves or oscillations which radiate from the antenna, and which, as said, are generated by the condenser discharge, either one or the other of two types of instruments are generally employed. One is called an oscillation transformer and the other a Helix.

The Helix instrument is the more efficient, but the former offers certain advantages, especially when the primary power exceeds half a kilowatt. The Helix has the advantage of simplicity and immunity from breakdown, whilst the transformer is more costly to manufacture, more complicated, and is more liable to cause trouble through breakdown, although it should be mentioned that this latter is an extremely rare occurrence.

A spark gap, preferably enclosed by some well-insulating and non-hydroscopic material, is also an essential.

Two diagrams, Figs. 1 and 2, show the complete transmitter connections of two plants, using apparatus as described.

Diagram Fig. 1 shows the arrangement of apparatus suitable for working up to a minimum distance of 100 miles, whilst Fig. 2 represents a more powerful installation for working up to 200 miles.

It may be of interest to give here a brief explanation of the generation of the oscillations which can operate suitable receivers over such great distances. If the reader will consider the case of a simple pendulum capable of swinging to and fro, or, in othe

words, performing a series of oscillations, and will assume this pendulum to be held some distance from its vertical axis, and then suddenly released, it will be noticed (a) the pendulum oscillates and finally comes to rest, (b) it oscillates at a certain definite rate, (c) that the rate or frequency of oscillation is not affected by the amplitude of each swing. As is well known, the rate of oscillation is determined by the weight of the bob and the length of the pendulum or the distance from the pivot or point of suspension to the center of the weight.

To consider the electrical equivalent. The condenser corresponds to the weight, and the length of

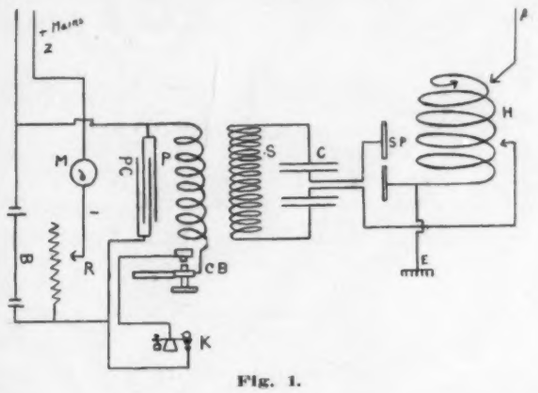


Fig. 1.

the wire between it and the spark gap to the distance. Owing to this gap, the induction coil or transformer is enabled to charge the condenser up to a certain point—determined by the distance separating the two electrodes — when suddenly the strain becomes too great, and a spark is produced. Now, it is at this point that the oscillations are created, since the condenser in discharging does so in the same manner as the pendulum, viz., in an oscillatory manner.

On all vessels other than those of the Navy, the size of the condenser and the length of wire in its circuit must be such that oscillations occur at a frequency of 1,000,000 per second, at which frequency the antenna will radiate a wave of approximately 1000 feet or 300 meters length. This is a standard wave

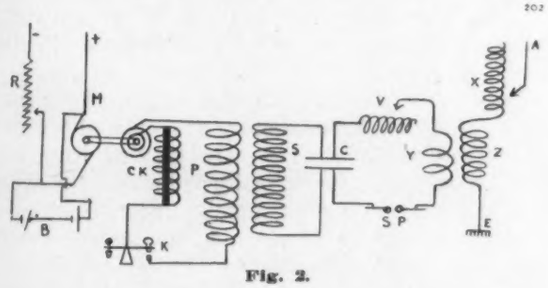


Fig. 2.

length for vessels, and they must be able to produce it. They may in addition be able to obtain any other wave length not exceeding 2000 feet or 600 meters, but the 300-meter standard must be adhered to, except in the cases of small vessels, when special waves may be allowed.

The object of thus standardizing wave-lengths is, primarily to enable all vessels of any nationality and carrying such receiving apparatus capable of being operated by "spark" transmitters to readily intercommunicate.

With regard to the receiving apparatus, there is little to be said. For practical radio-telegraphy, only those types of receivers which employ telephones worn by the operator are of any value. Of these there are several types available, but only two stand out well to the front of others. They are known as the electrolytic and the magnetic types respectively.

The former is by far the more sensitive, and is very reliable in the hands of a careful operator; but the latter is absolutely "fool proof." A good up-to-date installation should include both types of these receivers.

There are several recording receivers also on the market, but, although possessing certain advantages over the telephonic type, they are generally unreliable in their action, more or less complicated to adjust, and expensive; moreover, the speed of signaling with them averages only about 12 words per minute, whereas with the telephonic type speeds of 25 to 30 per minute or even more can be obtained; in fact, with telephonic receivers the speed is limited only according to the ability of the operators.

Radio-telegraphy plays a most important part in the working of His Majesty's Navy. Practically all men-of-war are fitted with apparatus designed in part by Mr. Marconi and by Capt. Jackson, R. N., the latter being one of the early experimenters. Constant communication is maintained throughout the different fleets, orders are given, and maneuvers executed from instructions radiated from the flagship.

The Admiralty building at Whitehall is equipped with a long-distance installation, and from its antenna messages from ships at sea are both sent and received. By this means the progress of maneuvers and latest information is obtained by headquarters. Some of the largest and more recent types of vessels have very powerful installations with a range of several hundred miles.

It is sometimes argued that the comparatively simple manner in which messages can be tapped would be disastrous during time of war, as the enemy would be able to receive signals intended for our own ships. This disadvantage is easily nullified when secret codes are used, and as a matter of fact it would be possible to cause considerable confusion amongst the opposing fleet if information likely to lead them astray were transmitted.

Dealing now with the commercial side, most of the large liners have installations and are open for public correspondence, and telegrams can be dispatched to and from the coast or other vessels.

When a ship station has traffic for shore the operator waits until the coast station required is nearest to the ship; he then signals the call of that place. On the reply being received the boat indicates the number of miles she is from the coast station, her bearing, course, speed, and the number of words to be transmitted; this information is supplied so as to enable the shore, in cases where two or more vessels require to communicate at the same time, to give preference to the boat whose position, etc., shows that she will be the first to pass out of range. After a telegram has been received by the coast station it is

then retransmitted over the landlines to the office of destination.

The rules for acceptance of radio telegrams are somewhat similar to those adopted by the British Postoffice. The cost of the message is made up of the ship station charge, the coast station charge, and the fee for transmission over the landlines. Money-order or reply-paid telegrams are not allowed.

Press messages containing the latest information from the outside world are sent daily from certain shore stations and are read by ships within range, which in their turn retransmit to other vessels in reach of their apparatus; the news received is then printed in the form of a newspaper and sold on board.

The operator requires to be a man with considerable technical knowledge as well as a skilled telegraphist; he cannot take charge of a ship station unless he holds the Postmaster-General's certificate, which is granted when an examination in sending, receiving, and practical wireless telegraphy has been passed.

The rules for working were framed at the Berlin Conference of the International Radio Telegraph Convention, for the purpose of arranging regulations, etc., whereby it is possible for ships of all nations to intercommunicate.

Before a ship registered in the United Kingdom can be installed with apparatus a license must first be obtained from the Postmaster-General, and certain restrictions are laid down as to power, wave length, etc. These stations must be opened from time to time to inspection by government officials. Vessels fitted are compelled to interchange telegrams with all coast stations, but are not bound to communicate with other ships except in cases of distress, when such distress signals take priority over all others. Next in importance to these come Admiralty messages. Coast and ship stations are required to suspend all other communication when requested to do so by the naval authorities.

An official list giving all information as to call signal, wave lengths, system used, normal range, hours of service, etc., is published by the International Telegraph Bureau at Berne, and all stations are required to possess a copy.

The Postmaster-General has power to cancel the license of any British ship failing to comply with the regulations laid down, or in the case of a foreign ship to authorize coast stations in the United Kingdom to refuse communication.

Some description of the action and construction of both the electrolytic and magnetic receivers may be of interest. The construction of the former is as follows: A fine glass tube about 2 cm. in length and 1 mm. bore has one of its ends drawn out to a point. Sealed in this point, and securely fastened to a thicker wire inside the tube is a fine platinum wire .02 mm. diameter.

The outside projecting portion of this wire, after the glass has been sealed upon it, is subsequently broken off, leaving only the cross-section exposed. The thicker wire inside the tube is attached to a stout silver plug, which slides easily through a brass collar which in turn forms a convenient support for holding the point in position.

Other parts of the instrument include a delicate potentiometer, three small dry batteries, a pair of delicate telephones, and a small cup containing a solution of caustic potash or dilute sulphuric acid.

The sensitiveness of the receiver depends to a very great extent on the telephone resistance, which should be as high as possible, generally of the order of 5000 to 6000 ohms the pair.

The point dips into the solution contained in the cup, and is polarized by the dry battery, a film of oxygen gas being produced on the fine platinum wire exposed.

On the arrival of the oscillation energy produced by a spark transmitter, the film of gas is heated and the resistance is reduced; more current therefore can flow through the telephone, and a click or buzz is

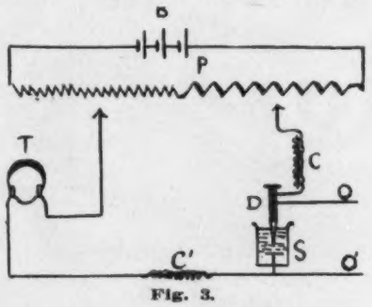


Fig. 3.

produced. The connections of this receiver are shown in Fig. 3.

The usual form of magnetic detector consists of an endless rope of silk-covered iron wire which passes around two pulleys about four inches in diamter, and kept in continuous motion by clockwork. This rope passes through a small glass tube upon which are wound a few turns in one layer of fine silk-covered copper wire. Over this and on a small bobbin is a second winding of much finer wire, this being connected to the telephones.

Two horseshoe magnets with their like poles adjacent and opposite the secondary bobbin complete the instrument. The action is very simple, being due to the fact that high-frequency oscillations tend to reduce the "hysteria" of iron, consequently, since the magnetic field is normally constant about the secondary winding, any oscillations in the primary cause a change in this state and secondary momentary currents are induced which in turn actuate the telephones.

There is another very practical type of magnetic detector, which has been recently devised and promises to far exceed in sensitiveness the moving rope kind, but as it is not yet commercially launched, the writer prefers to reserve further details for the moment. It can be mentioned, however, that the instrument has proved itself very applicable to wireless telephony.

In practice it is found necessary that all vessels should be provided with a suitable receiving tuning device. Just as it is possible to adjust the transmitter to radiate a wave of predetermined length, so it is possible to make the receiver respond to any given wave, and that wave only, within certain limits.

Of tuning devices there are a great number. They consist essentially of adjustable inductances and condensers, arranged in various ways.

Perhaps the best at the present time is the latest

Marconi device, which is the outcome of many years' study and experience. Fig. 4 shows a magnetic detector coupled to such a tuner, and it may be mentioned that very accurate results can be obtained with it. The advantage of having such a device is obvious, since once communication is established with a station, a rapid adjustment of the tuner brings the signals in much louder; at the same time any other stations in close proximity, working on a wave length differing only by perhaps 100 feet or 200 feet from the transmitting station's wave, can be readily cut out.

Of other similar apparatus, mention can be made of the De Forest three-coil tuner and the variometer.

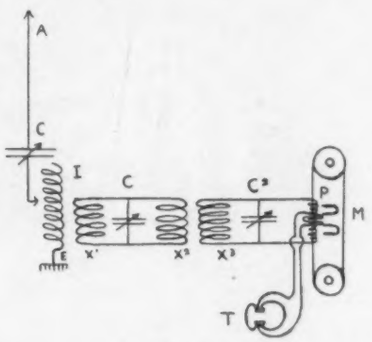


Fig. 4

This latter device is really one of the best types, since all sliding contacts are dispensed with. A simple movement of two superimposed windings in respect to their inductive relation to each other is all that is required to attune the receiver to the transmitter. The correct position is found to the minutest fraction of a degree in a few seconds. Furthermore, cheapness is another important factor in its favor.

There is one other piece of apparatus which it has been made compulsory to have on board, and that is a wave-meter or measurer. These instruments are of various types, but can be made up in a very portable form. As their name suggests, they are used to measure accurately the wave length transmitted and at times received.

Having thus mentioned and described all the principal apparatus necessary for a complete installation for a vessel, it now remains to summarize a few general points both as regards telegraphic working, initial and maintenance costs, etc.

It was stated in an earlier part of this article that certain distances could be covered subject to one exception. That exception is when communication is desired during severe atmospheric disturbances, such as thunderstorms. Just as these storms play havoc with ordinary telegraph and telephone lines, rendering not only the circuits unworkable, but at times dangerous to the operators, so do such storms render radio-telegraphic apparatus useless for the time being. It should, however, be noted that the antenna forms a very efficient protection to other parts of the vessel when lightning is present, provided it is well earthed on the ship's hull, and since it is always arranged so as to be out of reach of passengers, no personal harm from this source has ever been known to occur.

A question the writer has had asked him several times is, "Does the apparatus affect the compasses at all?" The reply is in the negative, provided the transmitting apparatus is placed about 10 feet or 20 feet from the instruments in question.

It is hardly within the scope of this article to deal with such questions as those of costs, since so many factors have to be taken into consideration, but a few approximate figures may be useful as a guide to those unacquainted with this class of apparatus.

A complete installation capable of working over a distance of one hundred miles or more should not exceed £70 to £80, and for a greater distance, say up to 200 miles, from £120 to £130. In addition to this there is the cost of installation, depending on the part of the world in which the vessel is situated. The depreciation on the plant is quite small, the chief item being the outside gear, including the antenna, insulators, ropes, etc., which must be renewed from time to time, say once a year. Five to six pounds should cover everything for the short-distance plant, and from £10-£15 on the other. Next comes the vexed question of the operator. That the apparatus requires to be handled with care and intelligence is undeniable; furthermore the operator must be able to send and receive messages by the Morse code at an average speed of twenty words per minute; but these facts do not necessitate the employment of a special man solely for the purpose of telegraphing. It is quite possible for a member of a crew to be trained in two or three months and obtain the government certificate, and the signaling could be made one of his duties at a comparatively slight increase of salary.

Before concluding this article a few words on the advent of commercial wireless telephony may be given. That this form of communication will eventually solve the qualified operator difficulty is unquestionable, but up to the present no great advancements have been made from a practical point of view. Experienced engineers have been able to hold telephonic communication over distances varying from 50 miles to 300 miles, but unreliability renders the commercial adoption of the system impossible.

That radio-telephony will shortly be within practical politics the writer is confident, since the production of the necessary oscillation energy is being accomplished by means of special dynamos or alternators, which are capable of giving frequencies of 240,000 per second. It is only owing to small mechanical difficulties which present themselves that these generators are not yet on the market, but that these difficulties will be overcome in the near future is unquestionable. Radio-telephony will then be as simple as ordinary telephony is at the present time.

In conclusion, it is hoped that considerable encouragement will be extended by ship owners to this branch of electrical science which can serve them so well and which has already shown itself worthy to be classed among the great discoveries of the nineteenth century.

Electric crop forcing is to be investigated and financed by the recently organized Agricultural Electric Discharge Company of London.

Electric control of guns on battleships, the invention of Rear Admiral Sir Percy Scott, is being tested by the British Navy.

A STUDY OF THE EFFECT OF SULPHUR IN ILLUMINATING GAS ON THE AIR IN ROOMS.

Mr. Arthur D. Little, chemical expert and engineer, Boston, Mass., has recently completed an exhaustive series of experiments to determine the effect of sulphur in illuminating gas upon the air in rooms. In an ordinary dwelling house a single room was set apart for the experiments and apparatus was provided to determine the amount of gas burned within the room, the amount of sulphur originally contained in the gas, the amount of sulphur present in the air of the room, its rate of disappearance and its effect upon objects and human beings. The occasion of these tests was primarily to determine whether a reasonable amount of sulphur in excess of 20 grains per 100 cubic feet, which is the present Massachusetts limit, would prove in any way objectionable. It was shown that under the existing limitations a special hardship was imposed upon the gas producer because of the increasing difficulty of securing coal so low in sulphur as to make possible the manufacture of gas containing not over 20 grains of sulphur to the one hundred cubic feet. Mr. Little has traced out and presented in a very comprehensive report the conditions which originally prompted stringent sulphur limitations. It is his opinion that for the most part these were without justification, and that the liability of danger from sulphur gases has been greatly misunderstood and exaggerated. Also that the removal of sulphur restrictions from gas or an increase in the amount permissible will cause no inconvenience, is attested to by the fact that the gas authorities and examiners of London unanimously report that the removal of restrictions in that city, to such an extent that oxide purification alone is now used, has occasioned no complaints and has proved to be so thoroughly satisfactory that it has since been greatly extended throughout England. It is also a noteworthy fact that the inhabitants of other districts in this country free from sulphur regulations (and but a surprisingly small percentage of the country has any such regulations) do not appear to make any complaints that would indicate inconvenience from sulphur in gas.

The report shows that sulphur gases formed by the combustion of illuminating gas are removed from the air of rooms in three ways: By the changing air in the ordinary course of ventilation, by condensation along with water vapors on the cold walls and windows, and through absorption by the alkaline constituents of the walls and ceilings. It was very clearly demonstrated that other conditions being the same it is only within narrow limits that an increase in the amount of sulphur in the gas or of the rate at which gas is burned causes a relative increase in the sulphur to be found in the atmosphere of the room. When the sulphur present in this atmosphere increases markedly, the more rapid is the reaction between the plaster of the walls and ceilings and the sulphur gases. That is to say, the plaster takes up the sulphur gases with greater rapidity. Calculation, however, shows that the plaster of an ordinary ceiling would serve to absorb sulphur gases from 20 grains gas burning 25 feet per day during the probable existence of a house. It is therefore evident that in the ordinary dwelling the plaster serves automatically to prevent a material increase of the sulphur in the air, even though there be a great increase in that contained in the gas. The relation of this fact to the hygienic conditions must be manifest. In fact it was shown that the outside atmosphere contained at times one-third to one-fourth as much sulphur as may be found in an ordinary gas lighted room. In a well ventilated room with one or more occupants it was shown that the lighting of the gas would cause such a small rise in the sulphur present as to in no way become manifest to the senses. In fact it was shown that the sulphur would have to be increased many times that of the ordinary room before the senses would be able to detect it.

A careful search through many of the larger works on physiology and physiological chemistry failed to discover any information on the physiological effects of sulphur dioxide. In many of the lists that included carbon dioxide, carbon monoxide, methane and chlorine among the poisonous gases, no mention was made of sulphur dioxide. The sulphur gas commonly mentioned as being poisonous was hydrogen sulphide. The most definite statement found regarding sulphur dioxide simply stated that "sulphur dioxide in large amounts is toxic."

When the concentration of sulphuric acid in the atmosphere rises to about four parts per million in the air it is claimed that the gas can be perceived, not by the smell, but as some describe it, by the taste. At five parts per million, gas can be distinctly smelled. In concentrations above this it produces more or less irritation of the nose and throat, and might therefore have a deleterious effect on the membranes of the air passages.

In none of the experiments conducted by Mr. Little did the sulphur dioxide exceed 0.8 part per million even under the most restricted ventilation, and when gas containing 36 grains of sulphur was used. It becomes evident therefore that in any room where people would live, on account of the carbon dioxide content, the sulphur dioxide from burning gas would never reach a point where it would be harmful.

Even under the most restricted conditions of ventilation it was shown that the burning of gas purified by oxide alone would not give rise to any odors of sulphur gases, and it was evident that any depressing effect was due to the large amount of carbonic acid liberated by the gas. In fact when a great excess of sulphur in the form of dioxide was artificially introduced into the room in addition to that liberated by the burning gas no odor of sulphur gases was noticeable. It was determined as regards the vitiation of the air by carbonic acid that one man had about the same effect as gas burning at the rate of five cubic feet per hour. Even when the ventilation in a room was restricted as much as possible the air changed 1.8 times per hour by diffusion through the plaster and walls. When the ventilation was rendered favorable for regular living conditions, the rate of change of air was several times greater than the figure just given. The influence of such rapid changes of air in a room in augmenting the absorptive effect of the plaster in preventing a high sulphur content is apparent.

The study of humidity conditions made it evident that but little condensation of moistures would

take place on the surfaces of articles in the room, and hence that there would be little or no formation of sulphurous or sulphuric acid, or of injury which might result from the presence of such acids. Metals exposed within the room and also out of doors showed but little difference in the tarnishing effect. No appreciable fading occurred in the case of a large number of dyed samples exposed to the effects of burning gas within the experimental room. The very small amount of sulphur actually discharged into the room by the burning of gas was shown by the fact that the lighting of an ordinary sulphur match would liberate as much sulphur into the room as ordinarily would be liberated by 20 grains burning for 22 minutes.

All of the experiments pointed very clearly to the fact that no injurious effects would result from the burning of gas containing an amount of sulphur materially in excess of 20 grains, and it was finally shown that a raising of the sulphur limitations on gas, while productive of no ill effects, would make available for the gas manufacturer a wider variety of coal, and as a consequence, by making unnecessary the wasteful mining methods followed in taking out low sulphur coals, would be an important practical step toward the conservation of one of the greatest of our natural resources.

NATIONAL IRRIGATION CONGRESS.

The National Irrigation Congress will hold its seventeenth session in Spokane, August 9th to 14th. Among the speakers already assigned are James J. Hill, Chairman of the Board of Directors of the Great Northern Railway Company; Howard Elliott, President of the Northern Pacific Railway Company; N. W. Harris, banker, Chicago; F. H. Newell, director of the Reclamation Service; N. W. Halsey, banker, New York; John Barrett, director of the International Bureau of the South American Republics; Dr. George B. Angell of Michigan; Gifford Pinchot, Chief of the Forest Service; Alva Adams, former Governor of Colorado; United States Senator Cummins of Iowa; Governor Gilchrist of Florida; Governor Willson of Kentucky; Governor Paterson of Tennessee, and United States Senator Jones of Washington.

WESTINGHOUSE MOTOR DEALERS' CONVENTION.

On June 14 and 15, 1909, a convention of the Westinghouse motor dealers is to be held at the San Francisco offices of the Westinghouse Electric & Manufacturing Company. The following papers are to be read:

Opening Remarks and General Statement as to Purpose and Intention of this Convention.....
.....By Mr. W. W. Briggs, Manager Westinghouse Office
"Motor Applications".....
By Mr. E. B. Parsons Westinghouse Electric & Mfg. Co.
"The Selection of Motors for Industrial Purposes".....
By Mr. R. H. Fenkhausen, E. E., Risdon Iron Works, S. F.
"Recent Developments of Westinghouse Apparatus".....
....By Mr. C. E. Heise, Westinghouse Electric & Mfg. Co.
"Installation and Operation of Motors and Transformers"
By Mr. Carl Holley, of the firm of Holley & Holley, Visalia, Cal.
"The Co-operation Between Contractors and Central Stations"
"Auxiliary Apparatus Applicable to Motor Installations for Industrial and Power Purposes".....
By Mr. J. E. Bridges, Detail Engineer Westinghouse Office.

CURRENT COMMENT

Baseball by electric light will soon be tested at the Cincinnati, Ohio, ball park. An Eastern inventor has devised a system of illumination which is to be given a thorough test. Five tall steel towers have been erected and mechanics are now at work installing artificial suns. The inventor claims the park will be flooded with such a strong light that it will be possible to execute any play in baseball that can be pulled off in daylight.

The duty on tungsten is causing the Senate considerable trouble. In a discussion on May 21st, concerning the imposition of a duty of 25 per cent ad valorem on tungsten, inquiry was made concerning the present price of tungsten. Senator Heyburn said that the price was $400 per ton; Senator Burton said that tungsten sold for $900 per ton; Senator Aldrich said he had been informed by men engaged in the tungsten industry that it sold for $1300 per ton, and Senator Nelson quoted from a pamphlet which stated that tungsten ranged in price from $1200 to $1500 per ton. As a result of the discussion the matter of duty on tungsten was put over for future consideration.

Tesla is to signal to Mars, according to a two-column letter to the New York Times. He believes that certain electrical disturbances which he observed in the summer of 1889 must have emanated from Mars, but that all doubt in this regard will soon be dispelled. He criticised unfavorably the various methods that have recently been proposed to convey signals to Mars, and offers one of his own which he states is simple in principle, although perhaps not easy of execution. This consists, first, of a circuit properly designed and arranged, with one of its ends connected to an insulated terminal at some height, and the other to earth. Inductibly linked with this is another circuit in which electrical oscillations of great intensity are set up, the above combination being known as the Tesla wireless transmitter. By a careful attunement of circuits, and by means of certain methods which he has not yet described, oscillations of transcending intensity can be obtained.

The Electrical Contractors' Association of England are to be congratulated on having at last gained the victory in a long-contested struggle. For years they have fought against municipal trading in electric wiring and fitting, and now they have the satisfaction of seeing a clause introduced into the "Electric Lighting Acts Bill" definitely prohibiting this form of unfair competition. During the report stage of this bill, Lord Avebury moved an amendment providing that where the undertakers were a local authority they might "through a contractor, but not otherwise," provide, let for hire, and fix, repair and remove, but should not manufacture, lamps, meters, electric lines, fuses, switches, fittings, lampholders, motors, and other fittings for lighting and motive power. Now that the contractors, by their persistence, have gained for the electrical industry the statutory recognition of their rights as traders and ratepayers, it remains for others to follow up the attack and drive it hard home.

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Business Efficiency

The efficiency of a small business is usually determined by comparing out-go with income. The business is a paying venture if this ratio be an improper fraction and is a losing one if it be proper. With a large business where this method is impracticable or where the efficiency is near unity it is better to find the losses and add them to the out-go to determine the income. The manifold advantages of the latter method has caused the adoption of a system of corporation book-keeping which will show where the loss as well as the gain takes place. It is essential that a manager know this and his success is often determined by his ability to minimize the loss.

There is probably no industry in which the efficiency of apparatus is more closely determined than in the electrical business where standards have been adopted and the results of physical investigation applied. It may be due to this fact that the electrical business is leading all others in the attainment of uniformity in accounting. Such is true not only in central station, railway, and telephone practice, but also in the manufacturing and selling end.

The first requirement in this arithmetical problem in ratio is to reduce to some common denominator the many factors that enter into it. This denominator depends largely upon the character of the business and the purpose to which the figures are to be applied; in traction work it may be the ton-mile, in central station the watt-hour, and in telephone practice the wire-mile or the station, and in general is some factor involving time, space, weight or wage. These factors are as varied as the forms of business enterprise that they comprise and include much data which may appear extraneous. Adopting the electrical analogy, the efficiency of a business as a whole varies with good or bad times much as that of an electrical system depends upon its load-factor. Internal friction, such as conflicts between employer and employee, have a great bearing on business success. Competition has many points in common with resistance, and freight charges and drayage with transmission and distribution.

Such comparison might be continued indefinitely but it is of merely passing interest. Whereas the greatest efficiency losses usually occur in the motors of an electrical system, so in a business it is upon the efficiency of his subordinates that the manager of a great corporation must rely. No standardization of routine yet devised will eliminate the personal equation. Yet great success is being obtained by setting a standard which gauges a man's efficiency by his record of performance. To the man this acts as an incentive for improvement and to the manager it indicates the unfit, who must obey the usual law of survival.

PERSONAL.

W. A. Purcell has been appointed San Francisco agent for I. P. Frink for the general line of Frink's reflectors.

A. T. De Forest, Pacific Coast manager of the American Steel and Wire Company, San Francisco, is now in the East.

Hugo Reisinger of New York City has received from the Emperor of Germany the commander's cross of the Order of the Crown of Prussia.

E. Ward Wilkins, secretary of the Partrick, Carter & Wilkins Company, Philadelphia, will make his annual Pacific Coast trip some time in July.

H. S. Tittle of the John G. Sutton Company, San Francisco, returned June 7th after a month's trip through British Columbia and the Northwest.

P. H. Reardon of the Compressed Air Machinery Company of San Francisco, left this week for New York City on a trip which will include Pennsylvania and Ohio.

R. B. Daggett of the San Francisco office of the Electric Storage Battery Company is in the East and recently attended the conference of sales managers of his company held at Philadelphia.

H. C. Rice, vice-president and general manager of the General Incandescent Lamp Company, Cleveland, Ohio, will shortly take a trip abroad and is scheduled to sail from New York on June 17th.

An impressive ceremony was conducted off the port of San Francisco on Sunday, May 30th, when the ashes of H. D. Scribner, former local manager of the San Francisco office of the Allis-Chalmers Company, whose death occurred on April 4th, were strewn upon the sea in accordance with a wish expressed by Mr. Scribner some time ago.

J. R. Bibbins, who since 1902 has been associated with the Westinghouse interests at Pittsburg, Pa., recently serving the Westinghouse Machine Company as commercial engineer, after June 18th will become associated in the work of the Public Service Commission of New York as assistant to Mr. B. B. Arnold, consulting engineer and director of appraisals.

OBITUARY.

Irving Loveridge, general superintendent of the European interests of the Western Electric Company, and also manager of the London house of that company, died of pneumonia at Berlin on June 3d after an illness of three weeks.

Mr. Loveridge was a native of New York State and became associated with the Western Electric Company on leaving college. He gradually rose from the ranks to the position of purchasing agent and then assistant manager of the New York house, after which his appointment as manager of the Antwerp business necessitated his locating abroad. He was but recently appointed to the position he occupied at the time of his death.

SALES CONVENTION OF THE ELECTRIC STORAGE BATTERY COMPANY.

The Electric Storage Battery Company held a convention of its sales managers at the Bellevue-Stratford Hotel, Philadelphia, on May 27th, 28th and 29th. An opening address was made by the President and General Manager, Herbert Lloyd, and a paper was read by Charles Blizard, Third Vice-President and Manager of the Sales Department. Papers were also read by J. Lester Woodbridge, Chief Engineer of the company, Carroll Hodge, Manager of Construction; Joseph Appleton, Consulting Engineer, and others.

The following managers from the different sales offices were present: New York, Albert Taylor; Boston, Frank J. Stone; Chicago, G. H. Atkin; St. Louis, H. B. Marshall; Cleveland, H. B. Gay; Atlanta, H. H. Seaman; San Francisco, R. B. Daggett; Pennsylvania sales, E. L. Reynolds.

NEW CATALOGUES.

The H. W. Johns-Manville Company is distributing an attractive booklet with the title "Two Sides of the Story." It describes J-M Conduit and includes some illustrated examples of the old and new methods of conduit installation with the resulting saving in dollars by adopting modern methods.

The Electric Appliance Company of San Francisco have in press a revised edition of their well-known loose-leaf price list which has been brought up to date and will be found of the greatest convenience to the buyer of electrical supplies. The new edition of their general catalogue is also about ready for delivery and the catalogue and price list will be distributed to their numerous customers the latter part of this month.

Stanley & Patterson, Inc., New York City, are distributing a pamphlet just issued descriptive of their line of wireless battery material. It covers the line thoroughly, is completely illustrated and treats of the use of this material in connection with motor boat, automobile and general bell work. In addition to this information it includes rules governing pilots on the inland waters and other data of great value to motor boat owners.

Henry D. Sears of Boston, Mass., general sales agent of the specialties manufactured by the Weber Electric Company, has issued Catalog No. 2 describing the sockets, receptacles, rosettes, cut-outs, cleats, knobs, insulators, socket rings, etc., manufactured by the company. This line was placed on the market less than five years ago, and owing to its design, quality, workmanship, appearance, etc., has won a place in the front ranks.

TRADE NOTES.

The Standard Electrical Works have moved from their old location in New Montgomery street to the Roberts Building, 669-671 Mission street, where they are now permanently located.

The Standard Underground Cable Company announces that its general Pacific Coast offices will be located in the First National Bank Building, San Francisco, Cal., on and after June 19, 1909.

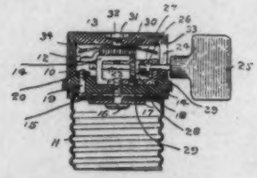
The California Incandescent Lamp Company are now permanently located in their new quarters at 669-671 Mission street, between Third and New Montgomery, with a complete stock of incandescent lamps, Holophane shades and reflectors and other material of this nature.

The Okonite Company, New York city, has recently changed from an English to a United States corporation, and has been organized under the laws of New Jersey. The following named gentlemen are the officers of the company: Willard L. Candee, president; H. Durant Cheever, treasurer; George T. Manson, general superintendent; William H. Hodgins, secretary. The main offices of the company are at 253 Broadway, New York city, and the factories at Passaic, N. J. This company is one of the largest manufacturers of high-grade insulated wire in this country.

The El Paso Street Railway Company of El Paso, Texas, which is controlled by Stone & Webster of Boston, has just closed contracts for the erection of a new power station. The building will measure 39x110 feet and will have steel framework and roof. The original installation will include one 2000-kw. Allis-Chalmers turbo-generator, two 600-kw. B. & W. boilers, equipped with superheaters, Taylor stokers, Alberger barometric condenser of sufficient capacity to take care of the old plant as well as the new, a large motor generator set, pumps, etc. The plant will be equipped for burning coal, and fuel conveyors and bunkers will be installed. The Stone & Webster Engineering Corporation is in charge of the work.

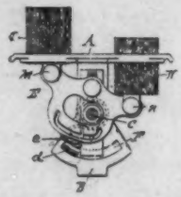
PATENTS

921,839. Key Socket Switch. Harvey Hubbell, Bridgeport, Conn. A switch of the character described, comprising a shaft, an angular block loosely carried thereby and carrying a pinion, a spring engaging the angular block, for the purpose



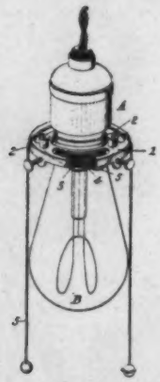
set forth, and a gear wheel meshing with the pinion and carrying a contact plate which rotates in a plane at right angles to the plane of rotation of the shaft.

922,443. Electric Switch. Walter Van Patten Steiger, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. In a switch of the character described, a pivoted contact member, a spring to actuate the same, and a detent adapted to oppose the



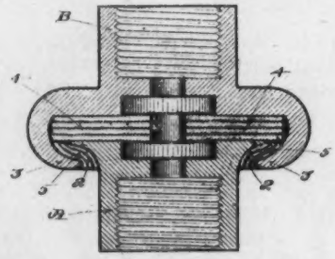
movement of said contact member, in combination with a rock lever provided with means to tension said spring and means to free said detent, said rock lever being pivoted eccentric to said contact member and provided with actuating means adjacent the pivoting point of said rocking lever to obtain a bell crank lever action of the character described.

922,406. Switching Device for Electric Lamps. Charles A. Elmer, Los Gatos, Cal. A switch device for electric lamps comprising a socket, a lamp bulb connected thereto, a shade bracket connected to the socket, tubes connected to the



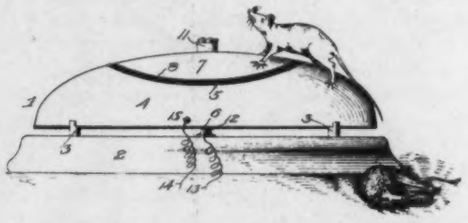
bracket, a clamp connected to the bulb and having an eye thereon, a string connected to the eye of the clamp, both ends of the string passing through the tubes and one string being for rotating the bulb for breaking the circuit and the other for making the circuit.

922,313. Insulator. Louis McCarthy, Boston, Mass., assignor to the Macallen Company, Boston, Mass. An insulator comprising metallic portions separated by laminated insulation and having the crevices and interstices of said laminated insulation free from air and moisture and filled with an



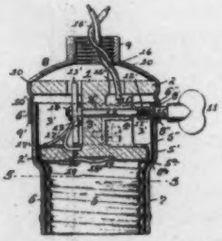
insulating compound consisting of Egyptian asphaltum and animal oil and mineral oil commercially known as ohmlac, said insulating compound being characterized by the quality that it becomes a thin liquid when subjected to a high degree of heat and solidifies at normal atmospheric temperature.

922,377. Electric Animal Exterminator. Byron S. Ames, Williamsport, Pa. In an electric animal exterminator, a base, a series of supporting posts arranged on said base, an inner semi-ellipsoidal body portion forming a contact piece or terminal of an electric circuit and supported by said base, a central supporting post or standard arranged in said base, a



flanged head on said standard, an outer contact portion arranged in the upper end of said inner portion and out of contact therewith and forming the other terminal of the electric circuit, and a bait receptacle on the flanged head of said post, and projecting above said outer contact portion.

921,199. Socket for Incandescent Electric Lamps. David E. Bown, Pittsburg, Pa. In a lamp socket, the combination of the inner shell, a cap, and a single solid base or block formed of insulating material within said shell and cap having a



partition within the same for forming recesses on each side of the same for the terminals and a projecting portion on the side of said partition for separating the connecting wires leading to the terminals.

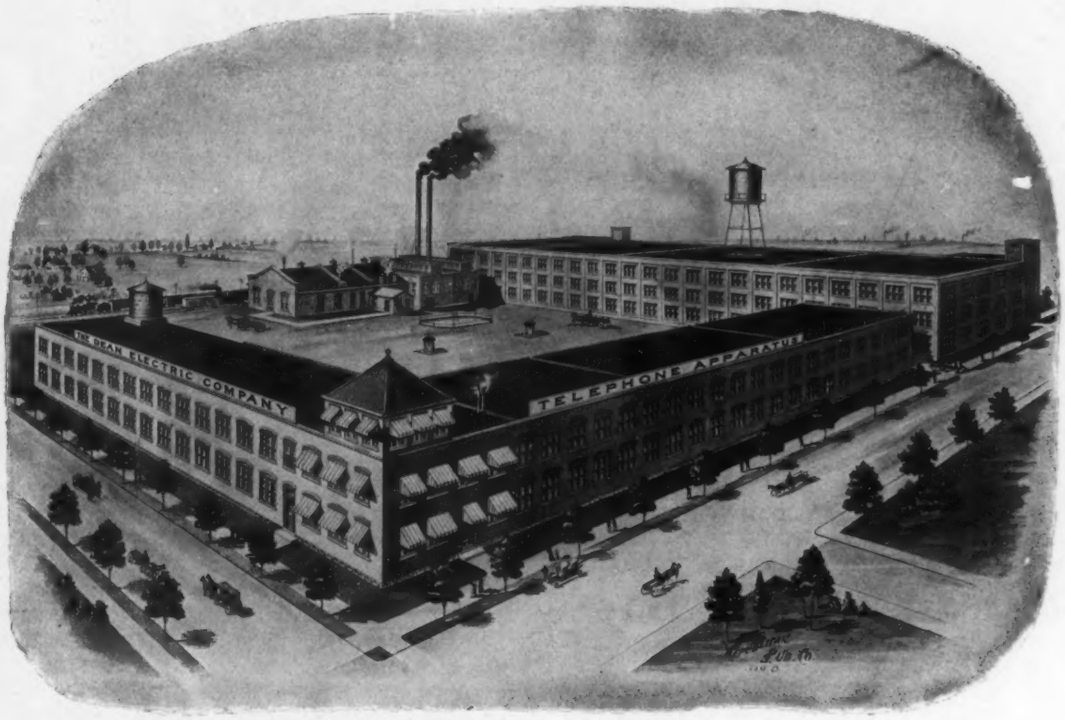
INDUSTRIAL

AN INDEPENDENT TELEPHONE PLANT.

BY FRED A. CORNELL.

With the expiration of underlying telephone patents, the introduction of competition gave an immense stimulus to the telephone industry. Along with the increasing demand for apparatus, came the organization of many bustling factories. Some of these have lived through the storms of hard times, and one of the largest in business today, is the Dean Electric Company.

The factory of this manufacturer is located on the main line of the Lake Shore & Michigan Southern Railroad in Elyria, Ohio. The property consists of 12 acres of level land with 1200 feet frontage directly on the railroad and 1300 feet on paved city streets. From this factory and by means of ample stocks of standard telephonic equipment maintained at Kansas City and San Francisco, the Dean product is well distributed all over the United States.



Manufacturing Plant of the Dean Electric Company.

The Dean plant includes a main L shaped factory of mill construction to which 140 foot addition has been added, an enameling and condenser shop which also provides space for an Underwriter's fire pump, a complete power and boiler house generating 940 horsepower, a one-story wood warehouse and a new three-story factory addition. In all, there is 120,865 square feet of floor space. The general shop and engineering offices occupy less than 10,000 square feet while all of the balance is utilized in handling or warehousing materials and products, in generating power, in bench and machine room for productive labor and in receiving, carrying and shipping facilities.

FIRE PROTECTION.

More than ample fire protection facilities are furnished by the storage of 100,000 gallons in the pool, and 50,000 gallons in the large tank on the top of the newest factory building, as shown in the illustration. This head of water is connected to a sprinkler system provided by some 2,063 Grinnell glass button automatic sprinklers whose valves fuse open at a heat of 155 degrees Fahrenheit. In other words, there is a sprinkler valve for every 8 feet square under roof, and the enormous tank provides a pressure of approximately 40 pounds of water to the square inch throughout the system. At least 50 pounds of steam pressure, for use in the 750 gallon per minute fire Underwriter's pump, is always available. This outfit is more powerful than the ordinary street engine and the flow can be applied to the sprinkler system or directly through the company's 800 feet of hose to any part of the property. In addition to the company's facilities for fire protection, an 8-inch main is tapped by three fire hydrants immediately adjoining the property and one other hydrant on a six-inch city main.

POWER PLANT.

The company's power facilities indicate the amount of actual productive work being done. Two Stirling type Babcock and Wilcox boilers provide steam for operating two Ball horizontal cross compound engines direct coupled to two Crocker-Wheeler 200 k. w. generators. These generators are easily capable of a 50 per cent overload for a short time. An auxilliary power outfit consists of a Westinghouse gas engine direct coupled to 75 k. w. Westinghouse generator. This smaller equipment is used very economically when only a few departments are running, as any overtime, etc.

There is a total of 940 horsepower available at any time during factory hours.

The boiler room, which is on the left as indicated by the position of the two large smokestacks, has a clear head space

of 30 feet from floor to roof trusses. The engine room on the right has a seven foot cement basement immediately under the engine floor. Through this space, the steam pipes and power leads are carried. There is 25 feet of clear space between the engine floor and the roof trusses. Adequate handling facilities are provided by a five-ton hoisting crane. In this building, adequate space is provided for increasing the present power facilities by 50 per cent without over-crowding either the present boilers or the generator units.

GENERAL OFFICES.

The general offices (windows covered by awnings in the illustration) are located on the first floor of the original factory building. The second floor is occupied by the engineering and drafting forces, while the small tower is utilized as an experimental and testing laboratory. These first and second floor offices are 60 square feet.

THE LATEST ADDITION.

The large new factory structure, in the right background of the illustration, has been completed to meet the constantly growing demands of the manufacturing departments. The entire top floor is utilized for telephone assembling and testing. Telephone parts are assembled on transversely built benches, and these products run smoothly to a long final assembling bench running the entire length of the building, along the third story windows shown in the illustration. Quickly and smoothly each part is placed in its proper position, being handled economically by an expert mechanic no matter how small and seemingly unimportant the work may be. In the rear of this floor, careful tests are applied by which the operating efficiency of each instrument is determined to an absolute degree. No single unit that does not come up to the most rigid tests is allowed to be placed on the elevators, dropped into the shipping room on the first floor and transferred to the cars.

The second floor provides ample space for the most convenient location of stock rooms. Carefully numbered and catalogued bins hold the various stocks of raw material and many pieces of material in process. The rapidly enlarging automatic screw machine department, comprising over two score different modern units, is rapidly outgrowing its present limits in the older factory building, and its growth is being looked out for on this second story of the new building.

The first floor provides ample head space for convenient handling of heavier materials. A most interesting piece of equipment is an enormous punch press used in the manufacture of the Dean indestructible steel mouth pieces and receiver shells. The rear of this floor houses the shipping department where cases are closed on the car level, with the delivery doors only the width of a small platform from the cars. In fact, both the receiving and shipping rooms are within a very few feet of the rails upon which the Twentieth Century Limited makes its daily record breaking flights.

GENERAL CONSTRUCTION.

In general, the Dean factory is a modern, sanitary, well lighted and heated factory of substantial, open beam, mill construction. As will be noted from the illustrations, the windows are extremely numerous and of ample size. Although it is possible to construct buildings that require less combustible material, it is highly improbable that any other type of construction would so economically meet the requirements for manufacturing telephone apparatus. The elasticity of semi-steel construction reduces the racking vibration from heavy punch press and machine operations.

SHIPPING FACILITIES.

The location in Elyria provides transportation facilities to reach immediately the larger telephone operators in the east and the growing interests in the middle west. Economically maintained branch house stocks, at Kansas City and San Francisco, promptly meet the needs of operators west of the Mississippi, and along the Pacific Coast. Deliveries to the Orient are being made through the San Francisco organization and shipments for Europe and South America are delivered on New York cars without any handling from the factory shipping platform to the loading crane of an ocean going vessel.

APPRECIATING ASSETS.

The Dean tract of land in Elyria provides space for vastly multiplying the present manufacturing facilities and both in manufacturing and residence values the surrounding property is developing rapidly. The city has but lately installed a new fire engine house within two blocks of the Dean plant. Improved streets and ample sewerage also mark the interest of the municipality in the most thriving section of a city that has doubled since 1900. Many Elyria factories were working overtime during 1908, and some industries, notably the Dean Electric Company, met panic-time pay rolls in gold.

WESTINGHOUSE EXHIBIT AT THE NATIONAL ELECTRIC LIGHT CONVENTION.

The large exhibition booth of the Westinghouse Electric & Manufacturing Company at the convention of the National Electric Light Association, Atlantic City, N. J., June 1st to 4th, occupied a central position in Young's Million-Dollar Pier, employing a decoration scheme harmonious with other principal booths, of a pergola covered with grape-vines. The booth illumination was carried out with various sizes and types of Westinghouse tungsten lamps, ranging from 5 to 250 watts. The new 5-watt, 4-candlepower tungsten sign lamps, exhibited for the first time at this convention, mean a great saving in current consumption for electric signs, for an account of the physiological effect of their greater intrinsic brilliancy these lamps are said to be as effective in signs as the duller carbon lamps of several times their candlepower. Series tungsten lamps for street lighting were exhibited, with both the paper cut-out and adjuster socket types of hanger receptacles; 40, 50 and 80-watt metallized-filiment lamps were also shown. The display of arc lamps included a large line of direct and alternating-current apparatus of series and multiple types, mill-type lamps and metallic-flame direct current arc lamps. The Cooper, Hewitt Electric Company exhibited its latest mercury arc lamps in this booth. Westinghouse mercury rectifier sets were shown for storage battery and other small direct current work. Storage batteries and parts were exhibited by the Westinghouse Machine Company. The motor display included a full line of shunt and compound wound direct current, and single, two and three-phase alternating current apparatus. A small motor generator set was used in demonstrating the operation of graphic recording meters, embracing a line of power, current, voltage, frequency and power-factor measuring instruments. Westinghouse portable and switchboard instruments, circuit-breakers, switches and choke-coils were also exhibited. The display of electric conveniences included electric sad irons of various types, introducing the new, rounded, pressed steel toe, tailor's goose irons, new electric toaster stove, hot plates, glue and chocolate warmers, luminous and non-luminous electric radiators, sewing machine and fan motors, etc.

The importance the Westinghouse interests attach to this convention is indicated by the fact that 32 representatives of their different companies were in attendance. These included Mr. W. M. McFarland, acting Vice President, the heads of the principal departments, representatives of all offices including Denver and the East, and the principals connected with the Westinghouse Lamp Company, the Westinghouse Machine Company, the Cooper Hewitt Electric Company, and the Nernst Lamp Company.

NEW TYPE KELLOGG SWITCHBOARD.

The Kellogg Switchboard and Supply Company has made numerous improvements in the express type magneto switchboard which it has had on the market for the past nine years.

Probably the most noteworthy improvement is the new No. 20 drop type combined self-restoring drop and jack. The No. 20 type has all of the advantages of the old No. 3 type, with the additional features of a platinum night alarm contact perfectly protected by the shield below the shutter, and a drop coil which can be removed in a few seconds' time by the aid of a screwdriver and without unsoldering any connections whatsoever. The entire operation of removing the drop coil is carried on from the rear of the board, so that it is not necessary to disturb the operator in any way. This feature will especially recommend itself to telephone companies operating in sections of the country where trouble is experienced from lightning or high-tension circuits. The front view of the switchboard illustrates the accessibility of any line on the board to any operator, and it is only necessary to transfer connections from subscribers appearing in the first two panels to those appearing in the last two, or vice versa. This not only inceases the speed of operation, but decreases the cost of operation. This point will be fully appreciated by operating companies who have been burdened with the type of board requiring the majority of connections to be transferred from one operator to another for completion.

The efficiency of operation has not been the only point considered in this type of switchboard, but special attention has been paid to the maintenance of the equipment. It is a very easy matter to change any drop coil without interfering with adjoining apparatus or in any way mutilating the cable forms. The cord terminals are conveniently located, and all other apparatus, such as condensers, repeating coils, induction coils, and other apparatus, are located on the hard maple panel in the rear of each position. All terminals are lettered and numbered in accordance with the blue print furnished with the switchboard.

All of these numerous advantages, added to the standard quality for which Kellogg apparatus has always been known, makes this magneto equipment unexcelled in efficiency and operation.

In addition to contracts which the Kellogg Switchboard and Supply Company recently made for complete new exchange equipments in Prescott, Arizona, and Mesa, Arizona, they have recently closed contracts for complete harmonic common battery exchanges in Jerome, Arizona, and Bisbee, Arizona.

Express Type Kellogg Magneto Switchboard.

ELECTRIC COOKING AT LOS ANGELES.

The Edison Electric Company of Los Angeles is giving to the people of that city an interesting demonstration of electric cooking in the San Fernando Building. Mrs. A. M. Colby of Boston is the demonstrator, and between 10 a. m. and noon and between 2 p. m. and 4 p. m. daily she shows how easy it is to prepare appetizing dishes by the aid of the appliances in the electric kitchen. A variety of electric cooking utensils and electric appliances of other kinds are shown.

WELSBACH EXHIBIT AT THE GAS EXPOSITION.

The exhibit of the Welsbach Company was one of the very interesting features of the Gas Exposition which was held in Oakland, California, during the two weeks ending May 29th, occupying an attractively decorated booth in which was placed a generous display of "Reflex" and "Junior" lights.

The exposition hall itself was illuminated by "Reflex" Cluster Lamps, "Reflexoliers" and "Humphrey" Inverted Arcs giving to the merchants of Oakland a demonstration of perfect illumination.

Other features of interest were a symphony concert given every afternoon and evening and cooking demonstrations by Mrs. Jean Sinclair and Miss Miriam Choynski.

The entire installation of the exhibit was under the direction of Mr. George V. Hollidge, Chairman of the Novelty Department of the Pacific Coast Gas Association.

Welsbach Exhibit at Oakland Gas Exposition.

Plans are now on foot for an exhibit of the same nature in San Francisco, which will be on a more elaborate scale.

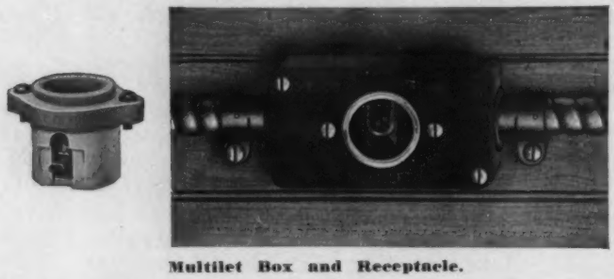
The following dealers made a very complete exhibit of heaters, gas stoves, etc.:

Ingram Hardware Company, "Prize" and "Sweepstakes."
John Breuner Company, "Geo. M. Clarke," "Jewel."
H. R. Basford & H. L. Delaney, the "Ruud Automatic Water Heater," "Excelsior" Gas Furnace, "New Method."
R. Dalziel Jr. Company, "New Method."
Pierce Hardware Company, "Garland."
Oakland Furnace Company, the "Hall" Gas Furnace
Welsbach Company, "Reflex" Lights, "Reflexoliers" and "Reflex" Cluster Lamps.
Busey Furniture Company, "Acorn."
Maxwell Hardware Company, "Ideal."
A. Schleuter & Company, "Cupid."
Jos. Thieben & Company, "Pittsburg Water Heater," "Automatic Estate."
J. J. Martin & Sons, "Douglas," "Eclipse" and "Real," "Economy."
Braley-Grote Furniture Company, "Garland."
Oakland Gas & Electric Appliance Company, "Reliable," "New Process," "Detroit Jewel."

A CONVENIENT RECEPTACLE AND BOX.

The accompanying illustrations show the Sprague Multilet with cover No. 6309 and the G. E. receptacle No. 60,931 which can also be seen in the box.

Unlike many other sign and outlet box receptacles this



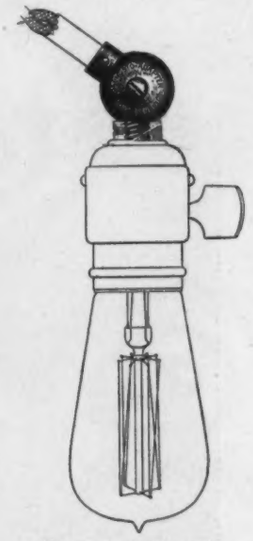
Multilet Box and Receptacle.

one is particularly adaptable to Sprague multilets for the reason that the screws securing the wire connections to the clips of the receptacle are tightened from the face of the receptacle and not from the back.

This obviates the necessity of having long wires within the box, an advantage which will be quickly appreciated by the wireman.

"TUNGSTO" ADAPTER

The tungsten lamp lasting longest when burned in a pendant position, it is necessary to use some form of adapter when connecting it to the ordinary chandelier socket, which points at an angle of about 45 deg. The Frank Mossberg



"Tungsto" Adapter.

Company, of Attleboro, Mass., manufactures the "Tungsto" adapter illustrated herewith.

The "Tungsto" adapter is applicable to any style of fixture and is interposed between the socket and the steam as indicated. This adapter is made in various finishes and holds the lamp rigidly in proper position.

S. & P. OIL GAS BURNERS.

An interesting exhibit at the Mechanics' Fair in San Francisco has been made of S. & P. Oil Gas Burners. Many successful tests have been made of installations of these burners, including tests made at the new U. S. postoffice and court house by U. S. Treasury Inspector G. B. Rice, assisted by chief engineer J. W. Hamilton, on July 31, 1905, under a 150 h. p. Heine water tube boiler, evaporating 15.80 pounds of water per pound of oil. Also the test at the Union Flour Mills, Stockton, by H. G. Balkwill, formerly chief engineer Stockton State Hospital, and A. E. Aubry, chief engineer of the mills, September, 1902, under two 250 h. p. Heine boilers evaporating 15.96 pounds of water per pound of oil in the first test and 16.50 in the second test at the mills. Also the unofficial report of the U. S. S. Cheyenne at Mare Island, making an evaporation of 15.50 pounds of water per pound of oil under four 600 h. p. B. & W. water tube boilers during her high efficiency trials. The Cheyenne is the first warship in the U. S. Navy to successfully burn oil under government conditions. Also the tests made in May, 1902, at the Western Sugar Refinery in a total of 28 different tests using air or steam to atomize, tests made in a gunboat type of boiler of 180 h. p. Tests authorized by the Oceanic Steamship Company under the directions of Ed. T. Morris, superintendent engineer for the company, assisted by J. S. Richards, chief engineer of the steamer Mariposa, and second assistant George W. Clark, the highest evaporation made at the test being 14.20 pounds of water per pound of oil under the positive and definite conditions imposed in the tests of all burners tried.

APPROVED ELECTRICAL DEVICES

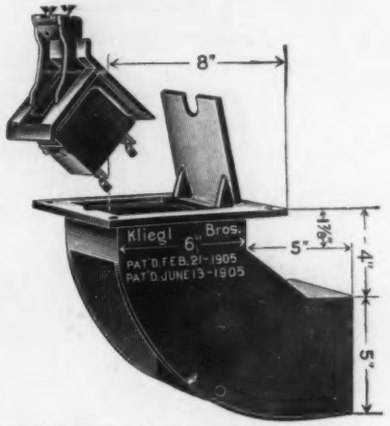
DESCRIPTION OF ELECTRICAL FITTINGS APPROVED BY THE UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION

Combination Joint.

Electric Joint.

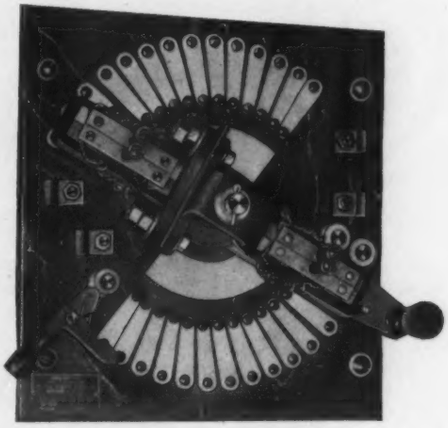
INSULATING JOINTS. "Flagg" combination and straight electric insulating joints. Approved March 17, 1909. Manufactured by **Flagg & Co., Philadelphia, Pa.**

Extra Plug.

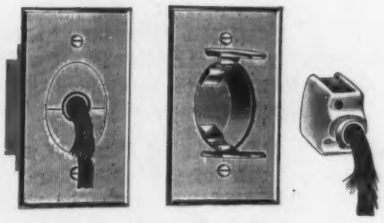


Single Flush Stage Pocket and Plug.

FLUSH STAGE RECEPTACLES. "Kliegl" stage pocket and receptacle, single and gang types. Cat. Nos. 216-219, inclusive, 350, 355, 360, 365, with Cat. No. 301 red fiber or boxwood plug with clamp for removing the strain of the cable from the terminals. 50 a., 125 v. Approved March 17, 1909. Manufactured by **Universal Electric Stage Lighting Co., New York, N. Y.**

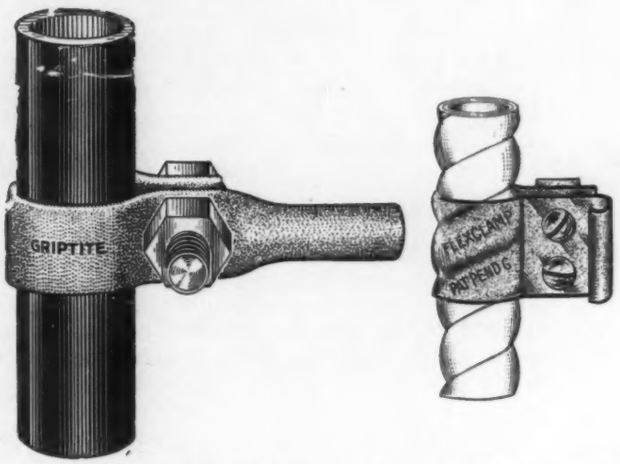


RHEOSTATS. Motor starters for squirrel cage type alternating current induction motors described in Manufacturers' Bulletin 18; 5-40 h. p. 110, 220 and 440 to 500 v. Resistance starters for two or three-phase circuits. With pressed steel casings having "hood and pan" at top and bottom. Approved March 16, 1909. Manufactured by **Cutler-Hammer Mfg. Co., Milwaukee, Wis.**



FLUSH RECEPTACLES. "Mesco" Flush Receptacle and Plug, 15 a., 250 v.; Cat. No. 6530. Approved April 7, 1909. Manufactured by **Manhattan Electrical Supply Co., New York.**

CONDUIT, UNLINED. "Enamelduct." Approved March 22, 1909. Manufactured by **C. S. Knowles, Boston, Mass.**



GROUND CLAMPS. "Griptite" clamps for rigid conduit in sizes for ½-inch to 3-inch pipe. "Flex-clamp" for Greenfield flexible steel conduits or armored cable, sizes A-E inclusive. Approved March 9, 1909. Manufactured by **Novelty-Electric Co., Philadelphia, Pa.**

TRANSFORMERS. G. E. transformers for use with arc lamps of moving picture machines. Primary voltages 200, 210 or 220. Secondary amperes 30-40-50 consisting of air cooled transformer mounted upon a slate base and provided with a switch regulating secondary current as indicated. Approved Feb. 13, 1909. Manufactured by **General Electric Co., Schenectady, N. Y.**

WIRES, RUBBER COVERED. Tag on coil to read "Nat'l Elec. Code Standard." Marking, green and black threads parallel in braid; black core. Approved Feb. 6, 1909. Manufactured by **Kerite Insulated Wire & Cable Co., New York.**

NEWS NOTES

TELEPHONE AND TELEGRAPH.

JACKSONVILLE, ORE.—The City Council has granted a franchise to the Citizens' Telephone Company.

MONROE, WASH.—The Independent Telephone Company will probably build a line up the valley in the near future.

BRIDGEPORT, ORE.—A telephone line is to be constructed between Bridgeport and Unity by John Thompson.

DAVENPORT, WASH.—The Farm & City Telephone Company has let a contract for the erection of a building, 26x26, two stories.

THOMPSON FALLS, MONT.—A. S. Ainsworth and associates has formed the Western Montana Telephone Company with a capital stock of $12,500.

MONTAGUE, CAL.—H. M. Bryan and others have been granted permission to erect and maintain a telephone line along the county road from the E. C. Roberts ranch to the town of Fort Jones.

LOS ANGELES, CAL.—The referendum has been invoked by 4,000 citizens, who signed a petition preventing the City Council from making operative a law allowing the Home Telephone Company to increase its rates on residence telephones $1 a month.

TACOMA, WASH.—General Manager William M. Godfrey announces that the general offices of the Home Telephone Company of Puget Sound will be removed from Portland to Tacoma and that $100,000 in improvements in the local system will be made this summer.

ALAMEDA, CAL.—Improvements involving an expenditure of $200,000 are about to be made in the telephone service and equipment in this city. Manager Brownlee of the local office states that all of the overhead wires in the city are to be put into cables, and the wires are to be entirely removed from Park street.

EUREKA, CAL.—County Manager A. E. McLaren of the Pacific Telephone Company received word from Superintendent Jesse B. Mortsolf of the Hoopa Indian Reservation several days ago that the proposed contract between the government and the telephone company for telephonic communication from Hoopa with the Pacific system though a connection at Korbel was expected from Washington shortly.

TELEPHONE CABLES CUT IN PASADENA.

Under date of May 27th, Superior Judge Bordwell of Pasadena, California, handed down a decision declaring it unlawful for the Pacific Telephone and Telegraph Company to erect telephone poles or wires for the transaction of business without a franchise or privilege from the City of Pasadena. The attorneys for the telephone company will carry the case to the higher courts.

Judge Bordwell's decision was in a suit brought by the telephone company against the City of Pasadena to test the validity of an ordinance which became effective in March, 1908. The ordinance was passed for the purpose of forcing the telephone company to apply for a license to erect poles and string wires and provided that without such license all poles and wires are "a public nuisance and any person maintaining them or assisting thereto shall be guilty of a misdemeanor and punishable therefor."

In summing up, the Court said:

"The effect of the ordinance in question is to require the plaintiff to remove his property from the streets of the city. The ordinance does not attempt to provide a means by which it may continue to occupy the streets. It seems to contemplate proceedings for the sale of the franchise to the plaintiffs under the provisions of the Broughton Act, of which the plaintiff may take advantage should he desire."

Judgment was entered for the defendant with costs. A temporary injunction which had been issued was dissolved by the Court.

On the face of it this decision is a serious one to the telegraph and telephone companies who have claimed that they are free from the regulation of cities and have rights under the Federal Government with which local municipalities cannot interfere. Under this decision, the cities have power to regulate all telegraph and telephone companies having lines of poles and operating therein. They can be forced to remove their poles from the cities and to obey all local regulations.

Following the issuance of the injunction by Judge Bordwell on May 27th, several squads of men under guard of the city police in Pasadena started cutting the wires and cables of the Pacific Telephone and Telegraph Company, and according to newspaper reports this work will be continued until the Pacific Telephone and Telegraph Company is completely obliterated from the city. The squads of wire-cutters placed 2700 telephones entirely out of commission in the first few hours' work.

The twenty-year franchise of the Pacific Telephone and Telegraph Company expired in 1907 and since then no franchise has been secured and no allowance paid to the city. The object sought is to force the telephone corporation to take out a new franchise and to pay a semi-annual tax of 75 cents on every pole.

FINANCIAL.

CENTRAL POINT, ORE.—The City Council at its next regular meeting will take the initial step for the issuance of water bonds in the sum of $25,000.

GLENDALE, CAL.—The City Council has passed an ordinance calling a special election to be held on June 22 to vote on the proposition of issuing and selling bonds in the sum of $60,000, for acquiring a municipal electric light plant.

EL CENTRO, CAL.—The Trustees have tentatively accepted the offer of W. F. Holt to sell to the city its domestic water system, lands used for canal and settling basins, and 120 shares of stock in water company No. 1. The board has passed a resolution accepting the offer providing a bond issue is voted and sold for this purpose. An election will soon be called.

OAKLAND, CAL.—No choice for president of the People's Water Company will be made until June 10th, when it is expected that Frank A. Leach will be in Oakland and will give the board of directors an answer to the offer made him of the presidency of the company. On that occasion a definite plan of operation will be decided upon and action taken on proposed improvements.

LOS ANGELES, CAL.—The certificate of creation and increase of the bonded debt of the Lytle Creek Power Company in the sum of $300,000 has been filed with the county clerk. The resolution was adopted by the board of directors and approved by the stockholders at a meeting held April 20th. The loan is for the purpose of retiring all present indebtedness, including the refunding of its present bonded indebtedness incurred on account of the installation of its present plant and system, and to pay all amounts acquired for the purpose of acquiring lands, equipment, machinery, to enlarge water rights, erect buildings, etc. The issue is to

be in the shape of 300 $1000 bonds, to be due and payable on the 1st of March, 1934, and to bear interest at the rate of 5 per cent per annum.

SAN FRANCISCO, CAL.—The merger of the United Railroads and the Stanislaus Electric Power Company, which has been in prospect for several months, has been effected by the filing of articles of incorporation in Redwood City by the Sierra and Francisco Power Company. The capital stock is placed at $20,000,000, of which sum $1000 is subscribed by the following: J. S. Thornton of Sonoma, Winfield Dorn of Oakland, H. J. P. Jackson of Berkeley, George H. Whipple of San Francisco, Warren Gregory of Berkeley. Of these Thornton, Dorn, Whipple and Gregory are connected with the law firm of Chickering & Gregory, which handled the negotiations between the United Railroads people and the original owners of the Stanislaus Electric Power Company. As yet neither the United Railroads of San Francisco nor the United Railroads Investment Company has appeared in the financial records, but these concerns are ready to act. Under the corporate name of the Sierra and San Francisco Power Company the property of the original Stanislaus Electric Power Company and the auxiliary power plants in San Francisco will be merged and given over to the control of a holding company, to be formed in the East under the auspices of the United Railroads Investment Company. The new San Francisco Electric Railway Company which recently took over the Parkside line, will be joined with the Sierra and San Francisco Power Company.

INCORPORATIONS.

SAN FRANCISCO, CAL.—Minoru Oil Company; capital stock $500,000;

FRESNO, CAL.—Alpine Oil Company; capital stock $75,000; by N. Benham, S. N. and L. L. Griffith.

EVERETT, WASH.—Northwest Light and Power Company of Everett; capital stock $400,000; by P. E. Hall Jr. and G. W. Numaw.

FRESNO, CAL.—Awalt Oil Company; capital stock, $200,000; by L. P. Timmins, G. W. Beall, E. Awalt, A. S. Cagwin and F. M. Pool.

SAN FRANCISCO, CAL.—Waratah Oil Company; capital stock $300,000; by A. L. Weil, M. Syme, E. B. Davis, Jesse Mueller and W. C. Eckhoff.

MODESTO, CAL.—Turlock Telephone Company; capital stock $50,000; by J. L. Randolph, J. C. Williams, A. J. Eddy, L. J. Gamwell and J. H. Miller.

RED BLUFF, CAL.—Beacon Oil and Gas Company; capital stock of $200,000; by Chas. Hughes, W. A. Fish, J. B. Reese, C. L. Cofer and H. M. Owens.

SAN FRANCISCO, CAL.—Palmer Annex Oil Company; capital stock, $2,000,000; by L. E. Blochman, F. L. Brown, G. l. Walker, L. A. Hilborn and H. W. Barnard.

SPOKANE, WASH.—The Mosso-Berry Electric Company has been incorporated to deal in electric supplies and do a general contracting business at 9 Browne Street.

SAN FRANCISCO, CAL.—Universal Wireless Telephone and Telegraph Company; capital stock $500,000; by J. H. McCarty, M. K. Miller, J. P. McCarty, F. P. Medina and F. P. Herrguth.

SAN FRANCISCO, CAL.—Alaska Commercial Oil Company of Seattle; capital stock $1,000,000; by W. B. Kavanaugh, S. C. John, Ralph Boykar, C. F. Sinclair and Clarence Cunningham.

RENO, NEV.—The articles of incorporation of the Midway and Maricopa Water Company of Fresno, Cal., and Reno, Nev., have been filed in this city. The purpose of the company is to secure water rights and power sites and generate electrical power as well as manufacture gas and heat.

FRESNO, CAL.—Camwell Oil Company; capital stock $500,000; by Wm. H. Crocker, George E. Cameron, Wellington Gregg Jr., Joseph D. Redding, Walter Stopford, W. R. Berry, E. Zimmer; principal place of business, San Francisco.

GOLDFIELD, NEV.—The Hawthorne Bodie Railway Company; capital stock $200,000; directors, Alonzo Tripp, Geo. W. Thatcher and A. M. Nye. The articles provide for the construction and operation of either a single or double track railway by either steam or electric power to the new camp of Lucky Boy, a distance of 16 miles.

ILLUMINATION.

TOMBSTONE, ARIZ.—The City Council has granted to C. L. Cummings a franchise to construct and operate an electric light and power plant.

ST. HELENS, ORE.—The City Council has decided to grant a 25-year electric light franchise to the Cormick Company. The cost of the plant will be about $12,000.

SAN DIEGO, CAL.—The city clerk is receiving sealed bids for furnishing labor and material for installation of ornamental iron posts, conduits and wiring on C street from Third to Sixth.

SAN DIEGO, CAL.—The city clerk is receiving bids for furnishing labor and material for installation of ornamental iron posts, conduits and wiring, and for furnishing of electric current, from the south line of B street to north line of C.

HANFORD, CAL.—Manager E. E. Bush of the Hanford Gas & Power Company states that the contract is virtually let to the H. D. Wood Co. of Philadelphia for a new additional gas tank, which will have a capacity of 100,000 cubic feet of gas.

NORTH YAKIMA, WASH.—The Hydro Electric Company has applied to the council for a franchise to use the streets of North Yakima for electric light and power purposes. The company will take water from the Yakima river and convey it through a flume into the Hoxoo valley.

PETALUMA, CAL.—At the Ramona Oil Company's plant in Vallejo township gas has been struck in large quantities. Superintendent McDonald says that the company had gone down 800 feet and had run into sand. The quantity of gas increases with the depth of the well.

GUADALAJARA, MEX.—W. Meridith of San Francisco and W. S. Dole of Portland, Ore., engineers who represent Eastern financial interests, are here to study the local situation in connection with the proposed establishment of a gas plant under the Dominguez-Sessions concession.

LOS ANGELES, CAL.—The litigation between the Hayes and the Lowe factions in the affairs of the People's Gas and Coke Company, ended with the sale at the Broadway side of the courthouse of the entire property to G. H. Hayes, the Goldfield mining man, for $10,000. He was the only bidder and he made but the one bid. The purchaser is one of the largest owners of the bonds of the corporation.

LOS ANGELES, CAL.—A group of local men have organized the Orange County Gas Company with a capital stock of $200,000 for the purpose of engaging in the gas producing and distributing business in Santa Ana and other points in Orange County, Santa Ana to be the location of the principal plant, although head offices will be maintained in Los Angeles. D. L. Peters, M. L. Bellius, John W. Kemp, E. B. Rhoades and John M. Mitchell, all of Los Angeles, are named as incorporators.

TRANSMISSION.

YREKA, CAL.—John Cameron has appropriated 6000 inches of water of Elk creek for power purposes.

HANFORD, WASH.—The Hanford Irrigation & Power Company will extend its transmission line from Coyote Rapids at once.

REDDING, CAL.—By a filing placed on record Tuesday afternoon David Dunn has appropriated 2,000 inches of the water under a 6-inch pressure flowing in Bailey creek for power and irrigating purposes.

SANTA BARBARA, CAL.—The Water Commissioners will receive sealed bids up to June 9th for furnishing 10,000 feet of No. 4-0 (0000) grooved, hard drawn copper trolley wire delivery to be f. o. b. cars or wharf.

EUREKA, CAL.—At the last meeting of the council committee of the whole, Mayor Ricks put before the Council his plans for a power plant on the water front so that water could be pumped from the bay and salt water used in fire fighting.

LOS ANGELES, CAL.—The Board of Public Works will receive sealed bids up to June 18th for furnishing electrical equipment, consisting of one 100 horsepower motor, two 10 horsepower motors, three 5 k. w. transformers, and 3 automatic circuit breakers.

NEVADA CITY, CAL.—Engineer Euren of the new electric plant on the Middle Yuba, has been in the field for two weeks, surveying for flues, ditches, etc. The power house will be located above the Plumbago plant, and will have an abundance of water for generating purposes, winter and summer. Power lines will be carried to Alleghany.

SALT LAKE CITY, UTAH.—The erection of a heating and power plant sufficiently large to take care of the building of the Temple block and a number of the large buildings in the vicinity, including the Utah Hotel, which is to be erected in the Old Deseret News corner, is the latest project in the direction of economy which is being taken up by Bishop C. W. Nibley and others.

PROSSER, WASH.—Manager Harry Benson of the Prosser Power Company announces plans for a new power plant which will develop all the wasted energy of the Prosser falls and rapids of the Yakima river, and eventually supply light and power for Prosser and the surrounding section and power for irrigation of lands above Sunnyside. A new canal 100 feet wide will be built. Two units of 500 horsepower each will be installed immediately in a stone power house to be erected at once.

REDDING, CAL.—A deed has been recorded here which transfers the C. W. Hamilton ranch and water right to the Northern California Power Company, Consolidated. This is one of the most desirable properties in the Battle Creek country, east of Redding, and consists of 540 acres, with about 850 inches of water running out of Battle, Mill and Brush creeks, which traverse the property. E. V. D. Johnson, manager of the interests of the Northern California Power Company, Consolidated, says that an additional unit from which 6000 horsepower will be obtained, should be ready early in July. Mr. Johnson says: "We expect to turn the water into South powerhouse for the generation of current early in July, and will then continue our units, until all are completed, when we will have a combined product of 27,000 horsepower, and this should be available by November 1st of this year. From this point we will go on to main Battle Creek, where the largest unit of all, 24,000 horsepower, will be installed. All of these installations will be completed by the end of 1910, making in all in that section available horsepower of $51,000."

TRANSPORTATION.

PHOENIX, NEV.—Dr. Chandler has been granted a street railway franchise on certain public highways in this city.

MONTEREY, CAL.—H. R. O'Bryn has made application to the supervisors for a franchise to construct a street railroad.

LOS ANGELES, CAL.—The Pacific Electric Railway has made an application to the supervisors for an electric railway franchise from E. Seventh street in Long Beach to Redondo avenue, to run 48 years.

SAN FRANCISCO, CAL.—The Central California Traction Company has commenced construction on its line between Lodi and Sacramento. Work has commenced at the Sacramento end and rapid headway is being made with the construction work. With the exception of a small section near Acampo the company has secured all of its rights of way.

OAKLAND, CAL.—The supervisors have granted the Oakland and Antioch Railway Company permission to use a portion of the Alameda County end of the Alameda and Contra Costa County tunnel. The points involved in the transaction hinged upon the authority of the supervisors to grant permission to the company to use the tunnel without the formality of applying for a franchise.

PORTLAND, ORE.—President Josselyn of the Portland Railway, Light & Power Company, gives out the budget for the year as follows: Sheds, foundry and repair shops, $500,000; cutting down bluff for same, unestimated; new plant above Cazedero, $2.500,000; extensions under recent franchise, $2,000,000; carbarns at Sellwood, $65,000; club house, $10,000; electric building, $250,000; steam station, $500,000.

ELLENSBURG, WASH.—The Kittitas County Commissioners have granted a franchise to the Sheelum Roslyn Electric Railway & Power Company, Frank S. Farquhar of Pittsburg, Pa., being the representative of the Eastern stockholders. The franchise stipulates that the road must be completed by December 1, 1911, and that as far as Rosalia it must be completed and in operation by December 1, 1909. The total length of the road will be 17 miles.

STANFORD UNIVERSITY, CAL.—A conference was held here Tuesday between Southern Pacific officials and representatives of the University in regard to the extension of an electric line across the University grounds. At the conference the following Southern Pacific officials were present: Paul Shoup, special representative of E. H. Harriman; Chief Engineer Hood, Division Superintendent Ahern and T. D. Chapin, superintendent of the interurban roads for the railroad. The University was represented by Trustees Timothy Hopkins, Charles G. Lathrop and Judge Leib and Prof. C. D. Marx of the civil engineering department.

SAN JOSE, CAL.—At the last meeting of the City Council City Clerk Walter reported that J. T. Burke had paid into his hands $11,000, the full amount of his bid for the street railroad franchise, which had been petitioned for by the San Jose Traction Company, and an order was made reciting the facts and ratifying the sale of such franchise to him. An ordinance granting such franchise to J. T. Burke was thereupon given first reading and laid over under the rule. It is the same as that which was asked for by the San Jose Traction Company. It is for a term of 50 years, and calls for a broad gauge standard electric road with first class equipment, and has the usual provision for improvement and care of streets between the tracks and for two feet on each side. Work is to be commenced within three months and completed within two years, with a provision for extensions of time for reasonable cause. After five years the holder of the franchise is to pay into the city treasury annually 2 per cent of the gross earnings of the road.